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ELECTRICAL ENGINEERING REGULATIONS

SUBCHAPTER J

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ELECTRICAL ENGINEERING REGULATIONS

SUBCHAPTER J

(Title 46, C. F. R., Parts 110 to 113, Inclusive)

CG–259

MARCH 1, 1967

UNITED STATES COAST GUARD
TREASURY DEPARTMENT

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March 1, 1967

FOREWORD

All the regulations governing the inspection of merchant vessels are contained in Chapter I, Title 46 (Shipping) of the Code of Federal Regulations (46 CFR). These regulations are applicable to certain merchant vessels which are subject to Title 52 of the Revised Statutes (secs. 4399–4500) and acts amendatory thereof or supplementary thereto. The specific application of these regulations is set forth in detail in the regulations.

The regulations in this pamphlet, "Electrical Engineering Regulations," CG–259, are copied from Subchapter J (Electrical Engineering) of Chapter I, Title 46, CFR. These regulations have been published in the Federal Register and have had full effect prior to March 1, 1967. The changes made in the text since the last edition are indicated by a star preceding the section, paragraph, or subparagraph numbers in the body of the text. This booklet replaces the prior edition of July 1, 1964.

These regulations are applied only in conjunction with Subchapter D (Tank Vessels), Subchapter H (Passenger Vessels), Subchapter I (Cargo and Miscellaneous Vessels), Subchapter T (Small Passenger Vessels), and Subchapter U (Oceanographic Vessels), after certain factors such as the size of the vessel, the service in which the vessel is engaged, and the waters upon which the vessel is operated are considered.

In this regard, shipowners, operators, builders, vessels' operating personnel and other persons affected by the navigation and vessel inspection laws should familiarize themselves with the regulations contained in this pamphlet. To this end, Coast Guard personnel concerned with the administration and enforcement of these laws, namely, the Coast Guard District Commander and the Officer in Charge, Marine Inspection, who have jurisdiction over Coast Guard inspection activities in the general area of the port in which he is situated, will extend, upon request, every possible assistance.

The regulations contained in other Subchapters of Chapter I of Title 46 CFR concerning the materiel inspection of merchant vessels are also reprinted in separate pamphlets.

P E Trimble

P. E. Trimble,
Vice Admiral, U.S. Coast Guard,
Acting Commandant.

Dist. (SDL No. 84)
A: None
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[1] The regulations in this pamphlet are copied from Chapter I of Title 46, Shipping, in the Code of Federal Regulations of the United States of America, as amended.

THE TERMINOLOGY FOR NUMBERING

This is an explanation of the numbering system used in Coast Guard pamphlets containing regulations and is the same as that used in the Code of Federal Regulations.

The regulations in regard to merchant vessel inspection are divided into chapters, subchapters, parts, subparts, sections, paragraphs, subparagraphs, and subdivisions. The chapters are numbered with a Roman numeral and the subchapters are given alphabetical designations. The parts in this pamphlet are numbered 110 to 113, inclusive. The terminology for numbering may be described as follows:

Terminology	*Example*
Part	110
Subpart	110.01
Section	110.01–1
Paragraph	110.01–1 (a)
Subparagraph	110.01–1 (a) (1)
Subdivision	110.01–1 (a) (1) (i)

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AUTHORITY: The provisions of this Part 110 issued under R.S. 4405, as amended, 4462, as amended; 46 U.S.C. 375, 416. Interpret or apply R.S. 4399, as amended, 4400, as amended, 4417, as amended, 4417a, as amended, 4418, as amended, 4421, as amended, 4426, as amended, 4427, as amended, 4433, as amended, 4453, as amended, 4488, as amended, 4491, as amended, sec. 14, 29 Stat. 690, as amended, sec. 10, 35 Stat. 428, as amended, 41 Stat. 305, as amended, sec. 5, 49 Stat. 1384, as amended, secs. 1, 2, 49 Stat. 1544, 1545, as amended, sec. 17, 54 Stat. 166, as amended, sec. 3, 54 Stat. 347, as amended, sec. 3, 70 Stat. 152, sec. 3, 68 Stat. 675; 46 U.S.C. 361, 362, 391, 391a, 392, 399, 404, 405, 411, 435, 481, 489, 366, 395, 363, 369, 367, 526p, 1333, 390b, 50 U.S.C. 198; E.O. 11239, July 31, 1965, 30 F.R. 9671, 3 CFR, 1965 Supp. Treasury Department Orders 120, July 31, 1950, 15 F.R. 6521; 167-14, Nov. 26, 1954, 19 F.R. 8026; 167-20, June 18, 1956, 21 F.R. 4894; CGFR 56-28, July 24, 1956, 21 F.R. 5659; 167-38, Oct. 26, 1959, 24 F.R. 8857.

110.01 BASIS AND PURPOSE OF REGULATIONS

110.01-1 Purpose of regulations

110.01-1(a) The purpose of the regulations in this subchapter is to set forth uniform minimum requirements for electrical apparatus and equipment when installed on various types of vessels in accordance with the intent of Title 52 of the Revised Statutes and acts amendatory thereof or supplemental thereto, as well as to implement various international conventions for safety of life at sea and other treaties which contain requirements regarding electrical apparatus or equipment. The regulations are necessary to implement the various provisions of law promulgated for the purpose of improving or promoting safety of life at sea.

110.01-5 Assignment of functions

110.01-5(a) By Reorganization Plan No. 3 of 1946, effective July 16, 1946, the marine inspection functions of the former Bureau of Marine Inspection and Navigation and its officers and employees were transferred to the Commandant, United States Coast Guard. By Reorganization Plan No. 26 of 1950, effective July 31, 1950 (15 F.R. 4935, 5 U.S.C. Note under 241), the functions formerly vested in the Commandant, United States Coast Guard, were transferred to the Secretary of the Treasury with certain specified exceptions. The Secretary of the Treasury by an order dated July 31, 1950 (15 F.R. 6521), delegated to the Commandant functions formerly performed by him under Reorganization Plan No. 3 of 1946.

110.01–10 Authority for regulations

110.01–10(a) *General.*

111.01–10(a)(1) The authority to prescribe regulations generally is set forth in R.S. 4405 and 4462, as amended (46 U.S.C. 375 and 416), as well as in other provisions of Title 52 of the Revised Statutes and acts amendatory thereof or supplemental thereto. Under the provisions of R.S. 4403, as amended (46 U.S.C. 372), the Commandant, United States Coast Guard, superintends the administration of the vessel inspection laws and is required to produce a correct and uniform administration of the inspection laws, rules, and regulations.

110.01–10(b) *Tank vessels.* The regulations regarding electrical apparatus and equipment which may be used on tank vessels interpret or apply R.S. 4417a and section 3(c) of Public Law 569, 83d Cong., 68 Stat. 676 (46 U.S.C. 391a, 50 U.S.C. 198), as well as Executive Order 11239, 30 F.R. 9671, 3 CFR, 1965 Supp.

110.01–10(c) *Passenger vessels.*

110.01–10(c)(1) The regulations regarding electrical apparatus and equipment which may be used on passenger vessels interpret or apply R.S. 4399, 4400, 4417, 4418, 4421, 4426, 4433, 4453, and 4488, as amended, section 14, 29 Stat. 690, section 10, 35 Stat. 428, 41 Stat. 305, 49 Stat. 1384, 1544, section 3, 54 Stat. 346, and section 3(c), Public Law 569, 83d Cong., 68 Stat. 676 (46 U.S.C. 361, 362, 391, 392, 399, 404, 411, 435, 481, 366, 395, 363, 369, 367, 1333, 50 U.S.C. 198), as well as Executive Order 11239, 30 F.R. 9671, 3 CFR 1965 Supp.

110.01–10(d) *Cargo and miscellaneous vessels.*

110.01–10(d)(1) The regulations regarding electrical apparatus and equipment which may be installed on cargo and miscellaneous vessels interpret or apply R.S. 4399, 4400, 4417, 4418, 4421, 4426, 4427, 4433, 4453, and 4488, as amended, section 14, 29 Stat. 690, section 10, 35 Stat. 428, 41 Stat. 305, 49 Stat. 1544, and section 3(c), Public Law 569, 83d Cong., 68 Stat. 676 (46 U.S.C. 361, 362, 391, 392, 399, 404, 405, 411, 435, 481, 366, 395, 363, 367, 50 U.S.C. 198), as well as Executive Order 11239, 30 F.R. 9671, 3 CFR, 1965 Supp.

110.01–10(e) *Uninspected vessels.*

110.01–10(e)(1) The regulations regarding electrical apparatus and equipment which may be installed on uninspected vessels interpret or apply section 17, 54 Stat. 166, as amended (46 U.S.C. 526p).

110.01–10(f) *Exemptions.*

110.01–10(f)(1) Public vessels owned by the United States, other than those engaged in commercial service, are to be exempt from the regulations in this subchapter. Certain other vessels may be exempt from the requirements of the regulations in this subchapter when so provided by law.

110.05 APPLICATION

110.05–1 Vessels subject to the requirements of this subchapter

110.05–1(a) This subchapter shall be applicable to all vessels as indicated in columns 3, 4, and 5 of Table 110.05–1(a) and shall apply to all such United States flag vessels, and to all foreign vessels which carry passengers from any port in the United States to the extent prescribed by law, except as follows:

110.05–1(a)(1) Any vessel of a foreign nation signatory to the International Convention for Safety of Life at Sea, 1960, and which has on board a current, valid safety certificate.

110.05–1(a)(2) Any vessel of a foreign nation having inspection laws approximating those of the United States together with reciprocal inspection arrangements with the United States, and which has on board a current, valid certificate of inspection issued by its government under such arrangements.

110.05–1(a)(3) Any vessel operating exclusively on inland waters which are not navigable waters of the United States.

110.05–1(a)(4) Any vessel laid up and dismantled and out of commission.

110.05–1(a)(5) With the exception of vessels of the U.S. Maritime Administration, any vessel with the title vested in the United States and which is used for public purposes.

110.05–3 Amendments to the regulations

110.05–3(a) The regulations in this subchapter are not retroactive in effect unless specifically provided for in the regulation at the time it is amended or added.

110.05–3(b) The regulations amended or added subsequent to November 19, 1952, are applicable to installations contracted for on or after the effective date of such regulations.

110.05–5 Specific application noted in text

110.05–5(a) At the beginning of the various parts, subparts, and sections, a more specific application is generally given for particular portions of the text involved. This application sets forth the types, sizes or services of vessels to which the text pertains, and in many cases limits the application of the text to vessels con-

★TABLE 110.05–1(a)

		Classes of vessels (including motorboats) examined or inspected under various Coast Guard regulations [1]			
Method of propulsion	Size or other limitations [1]	Vessels inspected and certificated under Subchapter D—Tank Vessels [2]	Vessels inspected and certificated under either Subchapter H—Passenger Vessels [2 3 4 5] or Subchapter T—Small Passenger Vessels [2 3 4]	Vessels inspected and certificated under Subchapter I—Cargo and Miscellaneous Vessels [2 5]	Vessels subject to provisions of Subchapter C—Uninspected Vessels [2 3 6]
Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
Steam	Vessels not over 65 feet in length.	All vessels carrying combustible or flammable liquid cargo in bulk.	All vessels carrying more than 6 passengers. [7]	All tugboats and towboats.	All vessels except those covered by columns 3, 4, and 5.[8]
	Vessels over 65 feet in length.	All vessels carrying combustible or flammable liquid cargo in bulk.[5]	1. All vessels carrying more than 12 passengers on an international voyage, except yachts. 2. All vessels of not over 15 gross tons which carry more than 6 passengers.[7] 3. All other vessels carrying passengers, except: a. Yachts. b. Documented cargo or tank vessels issued a permit to carry not more than 16 persons in addition to the crew. c. Towing and fishing vessels, in other than ocean and coastwise service, may carry persons on the legitimate business of the vessel, in addition to crew, but not to exceed one for each net ton of the vessel.	All vessels except those covered by columns 3 and 4.	None.
Motor	Vessels of not over 15 gross tons.	All vessels carrying combustible or flammable liquid cargo in bulk.	All vessels carrying more than 6 passengers.[7]	Those vessels carrying dangerous cargoes when required by 46 CFR Part 98 or 146.	All vessels except those covered by columns 3, 4, and 5.
	Vessels over 15 gross tons except seagoing motor vessels of 300 gross tons and over.	All vessels carrying combustible or flammable liquid cargo in bulk.[5]	1. All vessels carrying more than 12 passengers on an international voyage, except yachts. 2. All vessels not over 65 feet in length which carry more than 6 passengers.[7] 3. All other vessels of over 65 feet in length carrying passengers for hire except documented cargo or tank vessels issued a permit to carry not more than 16 persons in addition to the crew.	All vessels carrying freight for hire except those covered by columns 3 and 4.	All vessels except those covered by columns 3, 4, and 5.
	Seagoing motor vessels of 300 gross tons and over.	All vessels carrying combustible or flammable liquid cargo in bulk.[5]	1. All vessels carrying more than 12 passengers on an international voyage, except yachts. 2. All other vessels carrying passengers, except: a. Yachts. b. Documented cargo or tank vessels issued a permit to carry not more than 16 persons in addition to the crew.	All vessels except those covered by columns 3 and 4, and those engaged in the fishing, oystering, clamming, crabbing, or any other branch of the fishery, kelp, or sponge industry.	All vessels except those covered by columns 3, 4, and 5.
Sail	Vessels not over 700 gross tons.	All vessels carrying combustible or flammable liquid cargo in bulk.	All vessels carrying more than 6 passengers.[7]	Those vessels carrying dangerous cargoes when required by 46 CFR Part 98 or 146.	None.
	Vessels over 700 gross tons.	All vessels carrying combustible or flammable liquid cargo in bulk.	All vessels carrying passengers for hire.	Those vessels carrying dangerous cargoes when required by 46 CFR Part 98 or 146.	None.
Nonself-propelled	Vessels not over 100 gross tons.	All vessels carrying combustible or flammable liquid cargo in bulk.	All vessels carrying more than 6 passengers. [7]	Those vessels carrying dangerous cargoes when required by 46 CFR Part 98 or 146.	All barges carrying passengers except those covered by column 4.
	Vessels over 100 gross tons.	All vessels carrying combustible or flammable liquid cargo in bulk.	All vessels carrying passengers for hire.	All seagoing barges except those covered by columns 3 and 4; and those inland barges carrying dangerous cargoes when required by 46 CFR Part 98 or 146.	All barges carrying passengers except those covered by column 4.

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[1] Where length is used in this table it means the length measured from end to end over the deck, excluding sheer. This expression "means a straight line measurement of the overall length from the foremost part of the vessel to the aftermost part of the vessel, measured parallel to the centerline."

[2] Subchapters E (Load Lines), F (Marine Engineering), J (Electrical Engineering), and N (Dangerous Cargoes) of this chapter may also be applicable under certain conditions.

[3] Public nautical schoolships, other than vessels of the Navy and Coast Guard, shall meet the requirements of Part 167 of Subchapter R (Nautical Schools) of this chapter. Civilian nautical schoolships, as defined by 46 U.S.C. 1331, shall meet the requirements of Subchapter H (Passenger Vessels) and Part 168 of Subchapter R (Nautical Schools) of this chapter.

[4] Subchapter H (Passenger Vessels) of this chapter covers only those vessels of 100 gross tons or more. Subchapter T (Small Passenger Vessels) of this chapter covers only those vessels of less than 100 gross tons.

[5] Vessels covered by Subchapters H (Passenger Vessels) or I (Cargo and Miscellaneous Vessels) of this chapter, where the principal purpose or use of the vessel is not for the carriage of liquid cargo, may be granted a permit to carry a limited amount of flammable or combustible liquid cargo in bulk. The portion of the vessel used for the carriage of the flammable or combustible liquid cargo shall meet the requirements of Subchapter D (Tank Vessels) in addition to the requirements of Subchapter H (Passenger Vessels) or I (Cargo and Miscellaneous Vessels) of this chapter.

[6] Any vessel on an international voyage is subject to the requirements of the International Convention for Safety of Life at Sea, 1960.

[7] The meaning of the term "passenger" is as defined in the Act of May 10, 1956 (sec. 1, 70 Stat. 151; 46 U.S.C. 390).

[8] Boilers and machinery are subject to examination on vessels over 40 feet in length.

(R.S. 4405, as amended, 4462, as amended; 46 U.S.C. 375, 416) tracted for before or after a specific date. As used in this subchapter, the term "vessel contracted for" includes not only the contracting for the construction of a vessel, but also the contracting for a material alteration to a vessel, the contracting for the conversion of a vessel to a passenger vessel, and the changing of service or route of a vessel if such change increases or modifies the general requirements for the vessel or increases the hazards to which it might be subject.

110.10 REFERENCE SPECIFICATIONS, STANDARDS, AND CODES

110.10–1 General

The following specifications, standards, and codes, to the extent specified in the text, form a part of this subchapter:

110.10–1(a) Rules for the Classification and Construction of Steel Vessels, of issue in effect on the date the vessel is contracted for, issued by American Bureau of Shipping, 45 Broad Street, New York, N.Y. 10004.

110.10–1(b) Publications of issue in effect on the date the vessel is contracted for, issued by National Fire Protection Association, 60 Batterymarch Street, Boston, Mass. 02110, as listed in this paragraph.

110.10–1(b)(1) The National Electrical Code.

110.10–1(b)(2) Code for Use of Flammable Anesthetics (Safe Practice for Hospital Operating Rooms).

110.10–1(c) Standards of issue in effect on the date the vessel is contracted for, issued by National Electrical Manufacturers Association, 155 East 44th Street, New York, N.Y. 10017, as listed in this paragraph.

110.10–1(c)(1) NEMA Standards Publication Molded Case Circuit Breakers.

110.10–1(c)(2) NEMA Standards for Large Air Circuit Breakers.

★110.10–1(c)(3) NEMA Standards Publication Motors and Generators (MG1).

110.10–1(d) Standards of issue in effect on the date the vessel is contracted for, issued by the Institute of Electrical and Electronic Engineers, Box A, Lenox Hill Station, New York, N.Y. 14481, as listed in this paragraph.

110.10–1(d)(1) IEEE Standard No. 45—Recommended Practice for Electrical Installations on Shipboard.

110.10–1(d)(2) USA Standards Institute (formerly American Standard) Definitions of Electrical Terms, ASA C42.

110.10–1(e) Standards issued by Underwriters' Laboratories, Inc., 207 East Ohio Street, Chicago, Ill. 60011, as listed in this paragraph, each of issue in effect on the date the vessel is contracted for:

110.10–1(e)(1) Standard For Snap Switches.

110.10–1(e)(2) Standard For Knife Switches.

110.10–1(e)(3) Standard For Fuses.

110.10–1(e)(4) Standard For Industrial Control Equipment.

110.10–1(e)(5) Standard for Branch-Circuit and Service Circuit Breakers.

110.10–1(e)(6) Standard For Panelboards.

110.10–1(e)(7) Standard For Edison-Base Lampholders.

110.10–1(e)(8) Standard for Marine Type Electric Lighting Fixtures.

110.10–1(e)(9) Standard For Attachment Plugs and Receptacles.

110.10–1(e)(10) Standard For Flexible Cord and Fixture Wire.

110.10–1(e)(11) Standard For Electric-Discharge-Lamp Accessory Equipment.

110.10–1(e)(12) Standard For Elevator Electric Contacts and Elevator Hoistway Door Interlocks.

110.10–1(e)(13) Standard for Portable Electric Lamps.

110.10–1(e)(14) Standard for Wire Connectors and Soldering Lugs.

110.10–1(e)(15) Standard for Outlet Boxes and Fittings.

110.10–1(e)(16) Standard for Enclosed Switches.

110.10–1(e)(17) Standard for Commercial Electric Cooking Appliances.

★110.10–1(e)(18) Standards for Industrial Control Equipment for Use in Hazardous Locations, Subject 698.

110.10–1(f) Specifications and Guides issued by the U.S. Navy Bureau of Ships, Washington, D.C., 20360, of issue in effect on the date the vessel is contracted for, as listed in this paragraph.

★110.10–1(f)(1) MIL–C–915 Interim Specifications Cable, Cord and Wire, Electrical (shipboard use).

★110.10–1(f)(2) MIL–C–2194 Military Specifications Cable, Power, Electrical, Reduced Diameter Type, Naval Shipboard.

★110.10–1(f)(3) MIL–C–23206 Military Specifications Cable, Special Purpose, Electrical (Nuclear Plant).

★110.10–1(f)(4) NavShips 250–660–23, Cable Comparison Guide.

110.10–1(g) Standards of issue in effect on the date the vessel is contracted for, issued by USA Standards Institute, 70 East 45th Street, New York, N.Y. 10017.

110.10–1(g)(1) Safety Code For Elevators, Dumbwaiters, and Escalators.

★110.10–1(h) Recommended practices in effect on the date the vessel is contracted for, issued by Instrument Society of America, 530 William Penn Place, Pittsburgh, Pa. 15219:

★110.10–1(h)(1) Recommended Practice, Intrinsically Safe and Non-Incendive Electrical Instruments (RP 12.2).

110.10–5 Copies of specifications, standards and codes

110.10–5(a) Copies of the specifications, standards, and codes referred to in this subpart may be obtained from the issuing authority except:

★110.10–5(a)(1) Military specifications may be obtained from the Commanding Officer, Naval Supply Depot, 5801 Tabor Avenue, Philadelphia, Pa. 19120.

★110.10–5(a)(2) NavShips 250–660–23 may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.

110.10–5(b) Copies of the specifications, standards, and codes referred to in this subpart are available for reading purposes at Coast Guard Headquarters upon request.

110.15 DEFINITION OF TERMS USED IN THIS SUBCHAPTER

110.15–1 Approved

This term means approved by the Commandant, United States Coast Guard, unless otherwise stated.

110.15–5 Boat deck

This term means the deck or decks on which lifeboats are stowed.

110.15–10 Bulkhead deck

This term means the uppermost deck up to which the transverse watertight bulkheads are carried.

110.15–15 Cable terms

110.15–15(a) *Cable.*

110.15–15(a)(1) A cable is either a stranded conductor with or without insulation and other coverings (single conductor cable), or a combination of conductors insulated from one another (multiple-conductor cable).

110.15–15(b) *Cable designations.*

110.15–15(b)(1) Abbreviations given in Columns 1 to 5, inclusive, of Table 110.15–15(b)(1) may be employed in connection with lighting and power, interior communication, and telephone cable. Thus, in the abbreviation DRL–4, D=double conductor, light and power (column 1), R=rubber insulated (column 2), L=leaded and steel armored (columns 3 and 4), and —4=No. 14 American wire gage, 4110 circular mils (column 5). In the abbreviation ICTIA–12, IC=interior communication (column 1), T=thermoplastic-asbestos or thermoplastic-glass-asbestos insulated (column 2), I=impervious sheathed (column 3), A=aluminum armored (column 4), and—12=12 conductor (column 5).

110.15–15(b)(2) The trade designations given in Table 110.15–15(b)(2) may be used to designate the type of flexible cord and fixture wire.

110.15–20 Coast Guard District Commander

This term means an officer of the Coast Guard designated as such by the Commandant to command all Coast Guard activities within his district, which includes the inspection, enforcement, and administration of Title 52, Revised Statutes, and Acts amendatory thereof or supplemental thereto, and rules and regulations thereunder.

110.15–25 Coastwise

Under this designation shall be included all vessels normally navigating the waters of any ocean or the Gulf of Mexico 20 nautical miles or less offshore.

TABLE 110.15–15(b)(1)—*Lighting and power, interior communication, and telephone cable symbols*

Column 1	Column 2	Column 3	Column 4	Column 5
Symbol designating cable type	Symbol designating type of insulation	Symbol designating type of outer covering	Symbol designating type of armor	Symbol designating wire size for light and power cable or number of conductors for interior communication or number of pairs of conductors for telephone cable
S=single conductor, light and power. D=double conductor, light and power. T=triple conductor, light and power. F=four conductor, light and power. IC=interior communication. TT=twisted pair, telephone. TTC=twisted pair, inter-cabin telephone.	R=rubber. V=varnished-cambric. AV=asbestos-varnished-cambric. T=thermoplastic-asbestos or thermoplastic-glass-asbestos. MI=mineral insulated.	A=armored only. L=leaded and armored. I=impervious sheathed and armored. S=reinforced sheathed and armored.	None=steel. A=aluminum. B=bronze.	Circular mil size in thousands, or number of conductors, or number of pairs of conductors.

TABLE 110.15–15(b)(2)—*Portable cord and fixture wire symbols*

Trade name of wire or cord	Designation
Asbestos-covered heat-resistant fixture wire	AF
Silicone rubber insulated fixture wire	SF-2
Silicone rubber insulated fixture wire, flexible stranding	SFF-2
Asbestos-covered heat-resistant cord	AFC, AFPD
Rubber-jacketed heat-resistant cord	AFS, AFSJ
Heat- and moisture-resistant cord	AVPD
Lamp cord	O
Cotton-covered heat-resistant fixture wire, stranded or flexible stranded	CF
Cotton-covered heat-resistant cord	CFC, CFPD
Elevator cable	E, EO, ET
Rubber-covered fixture wire, flexible stranding	FF-2
Heat-resistant rubber-covered fixture wire, flexible stranding	FFH-2
Heater cord	HC, HPD
Jacketed heater cord	HS
Rubber-jacketed heater cord	HSJ
Braided heavy duty cord	K
Reinforced cord	P, P-2
Twisted portable cord	PD
Moisture-proof reinforced cord	PW, PW-2
Rubber-covered stranded fixture wire	RF-2
Heat-resistant rubber-covered stranded fixture wire	RFH-2
Hard service cord	S
Hard service cord, oil-resistant	SO
Hard service cord thermoplastic covered	ST
Junior hard service cord	SJ
Junior hard service cord, oil-resistant	SJO
Junior hard service cord, thermoplastic covered	SJT
Thermoplastic-covered stranded fixture wire	TF
Thermoplastic-covered fixture wire, flexible stranding	TFF

110.15–30 Commandant

This term means the Commandant of the Coast Guard.

110.15–35 Control equipment terms

110.15–35(a) *Electric controllers.* An electric controller is a device, or group of devices, which serves to govern, in some predetermined manner, the electric power delivered to the apparatus to which it is connected.

110.15–35(b) *Basic functions.* The basic functions of a controller are the functions of those of its elements which govern the application of electric power to the connected apparatus.

110.15–35(c) *Manual controller.* A manual controller is an electric controller having all of its basic functions performed by devices which are operated by hand.

110.15–35(d) *Full magnetic controller.* A full magnetic controller is an electric controller having all of its basic functions performed by devices which are operated by electromagnets.

110.15–35(e) *Contactor.* A contactor is a device for repeatedly establishing and interrupting an electric power circuit.

110.15–35(f) *Starter.* A starter is an electric controller for accelerating a motor from rest to normal speed, and to stop the motor.

110.15–35(g) *Automatic starter.* An automatic starter is a starter in which the influence directing its performance is automatic.

110.15–35(h) *Autotransformer starter.* An autotransformer starter is a starter which includes an autotransformer to furnish reduced voltage for starting of an alternating current motor. It includes the necessary switching mechanism, and it is frequently called a compensator or autostarter.

110.15–35(i) *Overload protection (overcurrent protection).* Overload protection is the effect of a device operative on excessive current, but not necessarily on short circuit, to cause and maintain the interruption of current flow to the device governed.

110.15–35(j) *Overload relay.* An overload relay is an overcurrent relay which functions at a predetermined value of overcurrent to cause disconnection of the load from the power supply.

NOTE: An overload relay is intended to protect the load (for example, motor armature) or its controller, and does not necessarily protect itself.

110.15–35(k) *Normally open and normally closed.* The terms "Normally Open" and "Normally Closed" when applied to a magnetically operated switching device, such as a contactor or relay, or to the contacts thereof, signify the position taken when the operating magnet is deenergized. These terms apply only to nonlatching types of devices.

110.15–35(l) *Temperature compensated overload relay.* A temperature compensated overload relay is an overload relay which functions at any current in excess of a predetermined value essentially independent of ambient temperature.

110.15–40 Corrosion-resistant finishes

The following treatments listed in this section, when properly done and of sufficiently heavy coating, are considered satisfactory corrosion-resistant finishes:

110.15–40(a) Electroplating of cadmium, chromium, nickel, silver, or zinc.

110.15–40(b) Sherardizing.

110.15–40(c) Galvanizing.

110.15–40(d) Painting. Thorough cleaning and degreasing, followed by bonderizing or the equivalent, followed by the application of zinc chromate primer or the equivalent, followed by one or more applications of enamel.

110.15–45 Corrosion-resistant or noncorrodible materials

Silver, corrosion-resisting steel, copper, brass, bronze, copper-nickel, certain copper-nickel alloys, and certain aluminum alloys are considered satisfactory corrosion-resistant or noncorrodible materials.

110.15–50 Electrochemistry

110.15–50(a) *Storage battery.* A storage battery is a connected group of two or more electrolytic cells for the generation of electric energy in which the cells after being discharged may be restored to a charged condition by an electric current flowing in a direction opposite to the flow of current when the cell discharges.

110.15–50(b) *Dry cell.* A dry cell is a cell in which the electrolyte is immobilized.

110.15–50(c) *Primary cell.* A primary cell is a cell which produces electric current by electrochemical reactions without regard to the reversibility of those reactions. (Some primary cells are reversible to a limited extent.)

110.15–55 Embarkation deck

This term means the deck or decks from which passengers embark into lifeboats or the deck or decks on which passengers are assembled preparatory to embarking into lifeboats.

110.15–60 Emergency squad

This term means that part of the crew designated by the station bill to form the nucleus of a damage control party.

110.15–65 Equipment enclosure terms

110.15–65(a) *Enclosed (inclosed).* Enclosed means surrounded by a case which will prevent a person from accidentally contacting live parts.

110.15–65(b) *Nonwatertight equipment.* Nonwatertight equipment means enclosed equipment, the enclosure of which is not sufficiently effective to be classed as either dripproof or watertight.

110.15–65(c) *Dripproof equipment.* Dripproof equipment means enclosed equipment so constructed or protected that its successful operation is not interfered with when subjected to falling moisture or dirt.

110.15–65(d) *Watertight equipment.* Watertight equipment means enclosed equipment so constructed that a stream of water from a hose (not less than 1 inch in diameter) under a head of about 35 feet from a distance of about 10 feet, and for a period of 5 minutes, can be played on the apparatus without leakage. The hose nozzle should be adjusted to give a solid stream at the enclosure.

110.15–65(e) *Explosionproof equipment.* Explosionproof equipment means equipment enclosed in a case which is capable of withstanding an explosion of a specified gas or vapor which may occur within it, and of preventing the ignition of the specified gas or vapor surrounding the enclosure by sparks, flashes or explosions of the gas or vapor within.

110.15–65(f) *Weathertight equipment.* Weathertight equipment means equipment so constructed or protected that exposure to a beating rain will not result in the entrance of water.

110.15–65(g) *Totally enclosed equipment.* Totally enclosed means so enclosed as to prevent circulation of air between the inside and the outside of the case, but not necessarily sufficiently to be termed airtight.

110.15–70 Equivalent

This term, when used in connection with a unit, material, process, finish, etc., means the equivalent as determined by the Coast Guard. (See Subpart 110.20.)

110.15–75 Ferry

Under this designation shall be included those vessels in other than ocean or coastwise service having provisions only for deck passengers and/or vehicles, operating on a short run on a frequent schedule between two points over the most direct water route, and offering a public service of a type normally attributed to a bridge or tunnel.

110.15–80 Flashpoint

This term indicates the temperature in degrees Fahrenheit at which a liquid gives off a flammable vapor when heated in an open-cup tester. (See Paragraph 111.70–5(e).)

110.15–85 Generation and distribution terms

110.15–85(a) *Connected load.* The connected load is the sum of the continuous ratings of the load consuming apparatus connected to the system or any part thereof.

110.15–85(b) *Load factor.* Load factor is the ratio of the average load over a designated period of time to the connected load.

110.15–85(c) *Peak load.* Peak load is the maximum load consumed or produced by a unit or group of units in a stated period of time. It may be the maximum instantaneous load or the maximum average load over a designated interval of time.

NOTE.—Maximum average load is ordinarily used. In commercial transactions involving peak load (peak power) it is taken as the average load (power) during a time interval of specified duration occurring within a given period of time, that time interval being selected during which the average power is greatest.

110.15–85(d) *Ground (earth).* A ground is a conducting connection, whether intentional or accidental, by which an electric circuit or equipment is connected to the earth, or to some conducting body of relatively large extent, which serves in place of the earth. It is used for establishing and maintaining the potential of the earth (or of the conducting body) or approximately that potential, on conductors connected to it, and for conducting ground current to and from the earth (or the conducting body).

NOTE.—On shipboard the "ground" or "earth" is the metal hull and all conductive parts connected thereto.

110.15–85(e) *Grounded* (earthed). Grounded means that the system, circuit, or apparatus referred to is provided with a ground.

110.15–85(f) *Ground-return circuit* (*earth-return circuit*). A ground-return circuit in which the earth is utilized to complete the circuit.

110.15–85(g) *Ground current.* Ground current is current flowing in the earth or in a grounding connection.

110.15–85(h) *Voltage to ground.* The voltage to ground is the voltage between any live conductor of a circuit and the earth.

NOTE.—Where safety considerations are involved, the voltage to ground which may occur in an ungrounded circuit is usually the highest voltage normally existing between the conductors of the circuit, but in special circumstances higher voltages may occur.

110.15–85(i) *Ground indication.* A ground indication is an indication of the presence of a ground on one or more of the normally ungrounded conductors of a system.

110.15–85(j) *Circuit.* A circuit is a conducting part or a system of conducting parts through which an electric current is intended to flow.

110.15–85(k) *Feeder* (*in interior wiring*). A feeder is a set of conductors originating at a main distribution center, and supplying one or more secondary distribution centers, one or more branch-circuit distribution centers, or any combination of these two types of equipment.

110.15–85(l) *Lighting feeder.* A lighting feeder is a feeder supplying principally a lighting load.

110.15–85(m) *Power feeder.* A power feeder is a feeder supplying principally a power or heating load.

110.15–85(n) *Branch circuit.* A branch circuit is that portion of a wiring system extending beyond the final overcurrent device protecting the circuit.

110.15–85(o) *Motor branch circuit.* A motor branch circuit is a branch circuit supplying energy only to one or more motors and associated motor controllers.

110.15–85(p) *Lighting branch circuit.* A lighting branch circuit is a circuit supplying energy to lighting outlets only. (Lighting branch circuits also may supply portable desk or bracket fans, small heating appliances, motors of 1/4 hp and less, and other portable apparatus of not over 660 watts each.)

110.15–85(q) *Appliance branch circuit.* An appliance branch circuit is a circuit supplying energy to one or more outlets to which appliances are to be connected; such circuits to have no permanently-connected lighting fixtures not a part of an appliance.

110.15–85(r) *Outlet.* An outlet is a point on the wiring system at which current is taken to supply fixtures, lamps, heaters, motors, or current-consuming equipment generally.

NOTE.—The use of the term outlet for a point in the wiring system where a switch is located is deprecated, unless qualified to make the meaning clear.

110.15–85(s) *Lighting outlet.* A lighting outlet is an outlet intended for the direct connection of a lampholder, a lighting fixture or a pendant cord terminating in a lampholder.

110.15–85(t) *Receptacle outlet.* A receptacle outlet is an outlet intended to be equipped with one or more receptacles, not of the screw-shell type, or provided with one or more points of attachment within one foot, intended to receive attachment plugs.

110.15–85(u) *Plug* (*plug adapter*). An attachment plug is a device which, by insertion in a receptacle, establishes connection between the conductors of the attached flexible cord and the conductors connected permanently to the receptacle.

110.15–85(v) *Appliance.* Appliances are current-consuming equipment, fixed or portable; for example, heating, cooking and small motor-operated equipment.

110.15–85(w) *Portable appliance.* A portable appliance is an appliance, fixed or portable, served by means of a flexible extension cord and/or attachment plug.

110.15–85(x) *Accessible* (*as applied to wiring methods*). Accessible means not permanently closed in by the structure or finish of the ship; capable of being removed without disturbing the ship structure or finish.

110.15–85(y) *Accessible* (*as applied to equipment*). Accessible means admitting close approach because not guarded by locked doors, elevation or other effective means.

110.15–90 Great Lakes

Under this designation shall be included all vessels navigating the Great Lakes.

110.15–95 Headquarters

This term means the office of the Commandant, U.S. Coast Guard, Washington, D.C. 20226.

110.15–100 Instrument and meter terms

110.15–100(a) *Instrument.* An instrument is a device for measuring the value of the quantity under observation. An instrument may be an indicating instrument or a recording instrument. The term "instrument" is used in two different senses: (1) Instrument proper consisting of the mechanism and the parts built into the case or made a corporate part thereof, and (2) the instrument proper together with any necessary auxiliary devices, such as shunt, shunt leads, resistors, reactors, capacitors or instrument transformers. The term "meter" is also used in a general sense to designate any type of measuring device, including all types of electric measuring instruments. Such use as a suffix or as part of a compound word (e.g., voltmeter, frequency meter) is universally accepted. Meter may be used alone with this wider meaning when the context is such as to prevent confusion with the narrower meaning of electricity meter.

110.15–100(b) *Indicating instrument.* An indicating instrument is an instrument in which only the present value of the quantity measured is visually indicated.

110.15–100(c) *Ammeter.* An ammeter is an instrument for measuring the magnitude of an electric current. It is provided with a scale, usually graduated in either amperes, milliamperes, microamperes or kiloamperes. If the scale is graduated in milliamperes, microamperes or kiloamperes, the instrument is usually designated as a milliammeter, a microammeter or a kiloammeter.

110.15–100(d) *Frequency meter.* A frequency meter is an instrument for measuring the frequency of an alternating current.

110.15–100(e) *Power-factor meter.* A power-factor meter is a direct-reading instrument for measuring power factor. It is provided with a scale graduated in power factor.

110.15–100(f) *Voltmeter.* A voltmeter is an instrument for measuring the magnitude of electric potential difference. It is provided with a scale, usually graduated in either volts, millivolts, or kilovolts. If the scale is graduated in millivolts or kilovolts the instrument is usually designated as a millivoltmeter or a kilovoltmeter.

110.15–100(g) *Wattmeter.* A wattmeter is an instrument for measuring the magnitude of the active power in an electric circuit. It is provided with a scale usually graduated in either watts, kilowatts, or megawatts. If the scale is graduated in kilowatts or megawatts, the instrument is usually designated as a kilowattmeter or megawattmeter.

110.15–100(h) *Instrument shunt.* An instrument shunt is a particular type of resistor designed to be connected in parallel with a circuit of an instrument to extend its current range. The shunt may be internal or external to the instrument proper.

★110.15–100(i) *Intrinsically safe instrument and equipment or wiring.* The term "intrinsically safe" when used with instruments and equipment or wiring shall mean such instruments and equipment or wiring that is incapable of releasing sufficient electrical or thermal energy under normal or abnormal conditions to cause ignition of a specific hazardous atmospheric mixture in its most easily ignited concentration. Abnormal conditions will include accidental damage to any part of the instrument and equipment or wiring, insulation, failure of electrical components, and other faulty conditions.

★110.15–105 International voyage

★110.15–105(a) The term "international voyage," as used in this subchapter, shall have the same meaning as that contained in Regulation 2(d), Chapter I, of the International Convention for Safety of Life at Sea, 1960; i.e., " 'International voyage' means a voyage from a country to which the present Convention applies to a port outside such country, or conversely; and for this purpose every territory for the international relations of which a Contracting Government is responsible or for which the United Nations is the administering authority is regarded as a separate country."

★110.15–105(b) The International Convention for Safety of Life at Sea, 1960, does not apply to vessels "solely navigating the Great Lakes of North America and the River St. Lawrence as far east as a straight line drawn from Cap de Rosiers to West Point, Anticosti Island and, on the north side of Anticosti Island, the 63d Meridian." Accordingly, such vessels shall not be considered as being on an "international voyage" for the purpose of this subchapter.

★110.15–105(c) For the purpose of this subchapter the term "territory" as used in paragraph (a) of this section shall be considered to include the Commonwealth of Puerto Rico, the Canal Zone, all possessions of the United States, and all lands held by the United States under a protectorate or mandate.

★110.15–105(d) Although voyages between the continental United States and Hawaii or Alaska, and voyages between Hawaii and Alaska are not "international voyages" under the provisions of the International Convention for Safety of Life at Sea, 1960, such voyages are similar in nature and shall be considered as "international voyages" and subject to the same requirements for the purpose of this subchapter.

110.15–110 Lakes, bays, and sounds

Under this designation shall be included all vessels navigating the waters of any of the lakes, bays, or sounds other than the waters of the Great Lakes.

110.15–115 Locations

110.15–115(a) *Corrosive location.* Corrosive locations shall be deemed to be locations exposed to the weather on vessels operating in salt water.

110.15–115(b) *Damp or wet location.* Damp or wet locations shall be deemed to be locations exposed to the weather, machinery spaces, cargo spaces, refrigerated spaces, galley, laundry, public washrooms or toilets equipped with baths or showers, and similar locations. Areas directly inside of access doors to a weather deck will also be classed as wet locations where the access door is not suitably protected against entrance of rain or spray by an overhanging deck or by other means.

110.15–115(c) *Dry location.* Dry locations shall be deemed to be passengers' and crew's quarters, pantries, passageways adjacent to quarters, public washrooms and toilets which are not equipped with baths or showers, radio room, gyro room, and chart room.

110.15–120 Marine inspector or inspector

These terms mean any person from the civilian or military branch of the Coast Guard assigned under the superintendence and direction of an Officer in Charge, Marine Inspection, or any other person as may be designated for the performance of duties with respect to the inspection, enforcement, and administration of Title 52, R.S., and acts amendatory thereof or supplemental thereto, and rules and regulations thereunder.

110.15–125 Motorboat

This term means any vessel indicated in Columns 4 or 5 of Table 110.05–1(a), 65 feet in length or less which is propelled by machinery (including steam). The length shall be measured from end to end over the deck excluding sheer. This term includes a boat temporarily or permanently equipped with a detachable motor and any such boat when so propelled is subject to the applicable provisions of the Act of April 25, 1940, as amended (secs. 1 to 22, 54 Stat. 163–167, as amended, 46 U.S.C. 526–526u), and the regulations promulgated thereunder. For the purpose of this subchapter motorboats are included under the term "vessel" unless specifically noted otherwise. The various classes of motorboats are as follows:

Class A—Any motorboat less than 16 feet in length.

Class 1—Any motorboat 16 feet or over and less than 26 feet in length.

Class 2—Any motorboat 26 feet or over and less than 40 feet in length.

Class 3—Any motorboat 40 feet or over and not more than 65 feet in length.

★110.15–128 Nuclear vessel

110.15–128(a) A nuclear vessel is a vessel provided with a nuclear powerplant for propulsion or any other purpose, or any vessel handling or processing substantial amounts of radioactive material other than as cargo.

110.15–130 Ocean

Under this designation shall be included all vessels navigating the waters of any ocean or the Gulf of Mexico more than 20 nautical miles offshore.

110.15–135 Officer in Charge, Marine Inspection

This term means any person from the civilian or military branch of the Coast Guard designated as such by the Commandant and who, under the superintendence and direction of the Coast Guard District Commander, is in charge of an inspection zone for the performance of duties with respect to the inspections, enforcement, and administration of Title 52, Revised Statutes, and acts amendatory thereof or supplemental thereto, and rules and regulations thereunder.

110.15–140 Passenger

A passenger is every person other than the master and members of the crew or other persons employed or engaged in any capacity on board a vessel in the business of that vessel. In the case of a vessel on an international voyage a child under one year of age is not counted as a passenger.

110.15–155 Propulsion engine

This term means one or more machines driving a single propeller or paddlewheel shaft for propulsion of the vessel.

110.15–160 Qualified person

(a) A qualified person is one who by his special knowledge, ability, and experience is able to competently and safely perform the required functions and duties.

110.15–165 Rivers

Under this designation shall be included all vessels whose navigation is restricted to rivers and/or canals, exclusively, and to such other waters as may be so designated by the Coast Guard District Commander.

110.15–170 Recognized classification society

The term "recognized classification society" means the American Bureau of Shipping or other classification society recognized by the Commandant.

110.15–175 Rotating machinery; enclosure, ventilation and protection terms

110.15–175(a) *Self-ventilated machine.* A self-ventilated machine is one which has its ventilating air circulated by means integral with the machine.

110.15–175(b) *Separately ventilated machine.* A separately ventilated machine is one which has its ventilating air supplied by an independent fan or blower external to the machine.

110.15–175(c) *Enclosed self-ventilated machine.* An enclosed self-ventilated machine is a machine having openings for the admission and discharge of the ventilating air, which is circulated by means integral with the machine, the machine being otherwise totally enclosed. These openings are so arranged that inlet and outlet ducts or pipes may be connected to them.

NOTE.—Such ducts or pipes, if used, must have ample section and be so arranged as to furnish the specified volume of air to the machine, otherwise the ventilation will not be sufficient.

110.15–175(d) *Enclosed separately ventilated machine.* An enclosed separately ventilated machine is a machine having openings for the admission and discharge of the ventilating air, which is circulated by means external to and not a part of the machine, the machine being otherwise totally enclosed. These openings are so arranged that inlet and outlet duct pipes may be connected to them.

110.15–175(e) *Open machine.* An open machine is one having ventilating openings which permit passage of external cooling air over and around the windings.

110.15–175(f) *Totally enclosed machine.* A totally enclosed machine is one so enclosed as to prevent exchange of air between the inside and the outside of the case, but not sufficiently enclosed to be called airtight.

110.15–175(g) *Totally enclosed fan-cooled machine.* A totally enclosed fan-cooled machine is a totally enclosed machine equipped for exterior cooling by means of a fan or fans, integral with the machine but external to the enclosing parts.

110.15–175(h) *Protected machine.* A protected machine is an open machine in which all openings giving direct access to live or rotating parts (except smooth shafts) are limited in size by the design of the structural parts, or by screens, grilles, expanded metal, etc., to prevent accidental contact with such parts. Such openings are of such size as not to permit the passage of a cylindrical rod ½ inch in diameter, except where the distance from the guard to the live or rotating parts is more than 4 inches they are of such size as not to permit the passage of a cylindrical rod ¾ inch in diameter.

110.15–175(i) *Dripproof machine.* A dripproof machine is one in which the ventilating openings are so constructed that drops of liquid or solid particles falling on the machine at any angle not greater than 15 degrees from the vertical, cannot enter the machine either directly or by striking and running along a horizontal or inwardly inclined surface.

110.15–175(j) *Explosionproof machine.* An explosionproof machine is one enclosed in a case which is capable of withstanding an explosion of a specified gas or vapor which may occur within it, and of preventing the ignition of the specified gas or vapor surrounding the enclosure by sparks, flashes or explosions of the gas or vapor within.

110.15–175(k) *Waterproof machine.* A waterproof machine is a totally enclosed machine so constructed that a stream of water from a hose (not less than 1 inch in diameter) under a head of 35 feet and from a distance of about 10 feet can be played on the machine from any direction for a period of 15 minutes without leakage, except that leakage which may occur around the shaft may be considered permissible, provided it is prevented from entering the oil reservoir and provision is made for automatically draining the machine. The hose nozzle should be adjusted to give a solid stream at the enclosure. The machine should be provided with a check valve for drainage or a tapped hole at the lowest part of the frame which will serve for application of drain pipe or drain plug.

110.15–177 Rules of the road

110.15–177(a) The term "Rules of the Road" means the statutory and regulatory rules governing navigation of vessels. These rules are also published by the Coast Guard in pamphlet form as follows:

110.15–177(a)(1) Rules of the Road—International—Inland (CG–169).

110.15–177(a)(2) Rules of the Road—Great Lakes (CG–172).

110.15–177(a)(3) Rules of the Road—Western Rivers (CG–184).

110.15–177(b) The current editions of the "Rules of the Road" pamphlets may be obtained from any Marine Inspection Office.

110.15–180 Short international voyage

For the purpose of this subchapter, the expression "short international voyage" means an international voyage in the course of which a vessel is not more than 200 miles from a port or place in which the passengers and crew could be placed in safety, and which does not exceed 600 miles in length between the last port of call in the country in which the voyage begins and the final port of destination.

110.15–185 Switching equipment

110.15–185(a) *Switches.*

110.15–185(a)(1) *Switch.* A switch is a device for making, breaking or changing the connections in an electric circuit.

110.15–185(a)(2) *Knife switch.* A knife switch is a form of air switch in which the moving element, usually a hinged blade, enters or embraces the contact clips. In some cases, however, the blade is not hinged and is removable.

110.15–185(a)(3) *Rated continuous current (of a switch or circuit breaker).* The rated continuous current of a switchgear device, or an assembly, is the maximum direct current, or rms current, in amperes at rated frequency which it will carry continuously without exceeding the limit of observable temperature rise.

110.15–185(a)(4) *Rated voltage (of a switch or circuit breaker).* The rated voltage of a device, or an assembly, is the voltage to which its operating and performance characteristics are referred.

110.15–185(a)(5) *General use switch.* A general use switch is a switch intended for use in general distribution and branch circuits. It is rated in amperes and is capable of interrupting the rated current at the rated voltage.

110.15–185(a)(6) *Isolating switch.* An isolating switch is a switch intended for isolating an electric circuit from the source of power. It has no interrupting rating and is intended to be operated only after the circuit has been opened by some other means.

110.15–185(a)(7) *Motor-circuit switch.* A motor-circuit switch is a switch intended for use in a motor branch circuit. It is rated in horsepower and is capable of interrupting the maximum operating overload current of a motor of the same rating at the rated voltage.

110.15–185(a)(8) *"T" rated switch.* A "T" rated switch is a switch intended to control tungsten-filament lamp loads.

110.15–185(a)(9) *Master switch.* A master switch is a switch which dominates the operation of contactors, relays, or other remotely operated devices.

110.15–185(b) *Interrupting devices.*

110.15–185(b)(1) *Circuit breaker.* A circuit breaker is a device for closing and interrupting a circuit between separable contacts under both normal and abnormal conditions.

NOTE.—Ordinarily circuit breakers are required to operate relatively infrequently, although some classes of breakers are suitable for frequent operation.

NOTE.—Normal indicates the interruption of currents not in excess of the rated continuous current of the circuit breaker. Abnormal indicates the interruption of currents in excess of such rated continuous current, such as short circuits.

110.15–185(b)(2) *Rated interrupting current (rated interrupting capacity).* The rated interrupting current of a circuit breaker is the highest current which the breaker is rated to interrupt at rated voltage and under specified operating duty. (As applied to breakers which allow the current to reach its maximum value, the rated interrupting current is the current at the start of the interrupting process. As applied to breakers which prevent the current from reaching its maximum value, the rated interrupting current is the highest available current of the circuit which the breaker is rated to interrupt.)

110.15–185(b)(3) *Reverse-power tripping.* Reverse-power tripping signifies the tripping of a circuit breaker upon reversal of power in the main circuit.

NOTE.—In direct-current practice the terms "reverse power" and "reverse current" are synonymous.

110.15–185(b)(4) *Undervoltage tripping.* Undervoltage tripping signifies the tripping of a circuit breaker by automatic means when the main circuit voltage decreases to a predetermined value.

110.15–185(b)(5) *Nonautomatic tripping.* Nonautomatic tripping signifies the tripping of a circuit interrupter only in response to an act of an operator.

110.15–185(c) *Fuses.*

110.15–185(c)(1) *Fuse.* A fuse is an overcurrent protective device with a circuit opening fusible member which is heated and severed by the passage of overcurrent through it.

110.15–185(c)(2) *Voltage rating.* The voltage rating of a fuse is the rms alternating or direct voltage for which it is designed.

110.15–185(c)(3) *Current rating.* The current rating of a fuse is the designated rms alternating, or direct current which it will carry continuously under stated conditions.

110.15–185(d) *Relays.*

110.15–185(d)(1) *Relay.* A relay is a device that is operative by a variation in the conditions of one electric circuit to effect the operation of other devices in the same or another electric circuit.

NOTE.—Where relays operate in response to changes in more than one condition, all functions should be mentioned.

110.15–185(d)(2) *Current relay.* A current relay is one that functions at a predetermined value of current. If may be an overcurrent relay, an undercurrent relay, a combination of both.

110.15–185(d)(3) *Overload relay.* An overload relay is an overcurrent relay which functions at a predetermined value of overcurrent to cause disconnection of the load from the power supply.

NOTE.—An overload relay is intended to protect the load (for example, motor armature) or its controller, and does not necessarily protect itself.

110.15–185(d)(4) *Voltage relay.* Voltage relay is one that functions at a predetermined value of voltage. (It may be an overvoltage relay, an undervoltage relay, or a combination of both.)

110.15–185(d)(5) *Instantaneous.* Instantaneous is a qualifying term applied to a relay indicating that no delay is purposely introduced in its action.

110.15–185(d)(6) *Inverse time.* Inverse time is a qualifying term applied to a relay indicating that its time of operation decreases as the magnitude of the operating quantity increases.

110.15–185(d)(7) *Overcurrent protection (overload protection).* Overcurrent protection operates to disconnect the protected equipment on excessive current.

110.15–185(d)(8) *Undervoltage protection (lowvoltage protection).* Undervoltage or lowvoltage protection is the effect of a device operative on the reduction or failure of voltage to cause and maintain the interruption of power in the main circuit.

110.15–185(d)(9) *Undervoltage release (lowvoltage release).* Undervoltage or lowvoltage release is the effect of a device operative on the reduction or failure of voltage to cause the interruption of power in the main circuit, but not to prevent the reestablishment of the main circuit on return of voltage.

110.15–185(d)(10) *Overspeed protection.* Overspeed protection operates to disconnect the protected equipment when the speed of rotation is in excess of a predetermined amount.

110.15–185(e) *Regulators.*

110.15–185(e)(1) *Regulator.* A regulator is a device which functions to maintain a designated characteristic at a pretedermined value, or to vary it according to a predetermined plan.

110.15–185(e)(2) *Generator voltage regulator.* A generator voltage regulator is a regulator which functions to maintain the voltage of a synchronous generator, condenser, motor, or of a direct-current generator, at a predetermined value, or vary it according to a predetermined plan.

110.15–185(f) *Switchgear assemblies.*

110.15–185(f)(1) *Power switchboard.* A power switchboard is a type of switchboard including main circuit switching and interrupting devices, together with their interconnections.

110.15–185(f)(2) *Live-front switchboards.* A live-front switchboard is one having exposed live parts on the front.

110.15–185(f)(3) *Dead-front switchboard.* A dead-front switchboard is one having no exposed live parts on the front, which constitutes a grounded metal barrier between the operator and the apparatus.

110.15–185(f)(4) *Distribution switchboard.* A distribution switchboard is a power switchboard used for the distribution of electric energy at the voltages common for such distribution within a ship.

NOTE.—Knife switches, air circuit breakers, and fuses are generally used for circuit interruption on distribution switchboards, and voltages seldom exceed 600. However, such switchboards often include switchboard equipment for a high tension incoming supply circuit and a stepdown transformer.

110.15–185(f)(5) *Automatic transfer equipment.* An automatic transfer equipment is one which automatically transfers a load so that a source of power may be selected from two or more incoming lines.

110.15–190 Vessel

110.15–190(a) Where the word "vessel" is used in this subchapter, it shall be considered to include all vessels indicated in Columns 3, 4 and 5 of Table 110.05–1(a) except as otherwise noted.

110.15–190(a)(1) *Cargo vessel.* Where the term "cargo vessel" is used in this subchapter it shall be considered to include all vessels indicated in Column 5 of Table 110.05–1(a) except as otherwise noted.

110.15–190(a)(2) *Passenger vessel.* Where the term "passenger vessel" is used in this subchapter it shall be considered to include all vessels indicated in Column 4 of Table 110.05–1(a) except as otherwise noted.

110.15–190(a)(3) *Tank barge; tank ship; tank vessel.* For definitions of these terms as used in this subchapter, see Paragraphs 111.70–5(i), 111.70–5(j), and 111.70–5(k) of this subchapter.

110.15–190(a)(4) *Barge.* Where the

term "barge" is used in this subchapter, it shall be considered to include all nonself-propelled vessels.

110.15–195 Western rivers

For the purpose of this subchapter, the term "western rivers" is as defined in CG–184, "Rules of the Road—Western Rivers."

110.20 EQUIVALENTS

★110.20–1 Conditions under which equivalents may be used

110.20–1(a) Where in this subchapter it is provided that a particular fitting, material, appliance, apparatus, or equipment, or type thereof, shall be fitted or carried in a vessel, or that any particular provision shall be made or arrangement shall be adopted, the Commandant may accept in substitution therefor any other fitting, material, apparatus, or equipment, or type thereof, or any other arrangement: *Provided*, That he shall have been satisfied by suitable trials that the fitting, material, appliance, apparatus, or equipment, or type thereof, or the provision or arrangement is at least as effective as that specified in this subchapter.

110.20–1(b) In any case where it is shown to the satisfaction of the Commandant that the use of any particular equipment, apparatus, or arrangement is unreasonable or impracticable, the Commandant may permit the use of alternate equipment, apparatus, or arrangement to such an extent and upon such condition as will insure, to his satisfaction, a degree of safety consistent with the minimum standards set forth in this subchapter.

110.25 SPECIAL PROVISIONS

110.25–1 Vessels acquired or documented under the Act of August 9, 1954

110.25–1(a) Vessels acquired or documented under the act of August 9, 1954 (sec. 3, 68 Stat. 675, 50 U.S.C. 198), shall be subject to the applicable provisions of Title 52 of the Revised Statutes, acts amendatory thereto and the rules and regulations thereunder.

110.25–1(b) Unapproved lifesaving, firefighting, and other equipment may be continued in service so long as, in the opinion of the Officer in Charge, Marine Inspection, such equipment is in good and serviceable condition. All replacements shall be in accordance with Coast Guard requirements for new vessels.

110.25–5 Installations of equipment made during the Unlimited National Emergency declared by the President on May 27, 1941

Boilers, pressure vessels, machinery, piping, electrical, and other installations, including lifesaving, firefighting, and other safety equipment, installed on vessels during the Unlimited National Emergency declared by the President on May 27, 1941, and prior to the termination of Title V of the Second War Powers Act, as extended (sec. 501, 56 Stat. 180, 50 U.S.C., App. Sup. 635), which do not fully meet the detail requirements of the regulations in this chapter, may be continued in service if found to be satisfactory by the Commandant for the purpose intended.

PART III—ELECTRICAL SYSTEM—GENERAL REQUIREMENTS

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AUTHORITY: The provisions of this Part 111 issued under R.S. 4405, as amended, 4462, as amended; 46 U.S.C. 375, 416. Interpret or apply R.S. 4399, as amended, 4400, as amended, 4417, as amended, 4417a, as amended, 4418, as amended, 4421, as amended, 4426, as amended, 4427, as amended, 4433, as amended, 4453, as amended, 4488, as amended, 4491, as amended, sec. 14, 29 Stat. 690, as amended, sec. 10, 35 Stat. 428, as amended, 41 Stat. 305, as amended, sec. 5, 49 Stat. 1384, as amended, secs. 1, 2, 49 Stat. 1544, 1545, as amended, sec. 17, 54 Stat. 166, as amended, sec. 3, 54 Stat. 347, as amended, sec. 3, 70 Stat. 152, sec. 3, 68 Stat. 675; 46 U.S.C. 361, 362, 391, 391a, 392, 399, 404, 405, 411, 435, 481, 489, 366, 395, 363, 369, 367, 526p, 1333, 390b, 50 U.S.C. 198; E.O. 11239, July 31, 1965, 30 F.R. 9671, 3 CFR, 1965 Supp. Treasury Department Orders 120, July 31, 1950, 15 F.R. 6521; 167-14, Nov. 26, 1954, 19 F.R. 8026; 167-20, June 18, 1956, 21 F.R. 4894; CGFR 56-28, July 24, 1956, 21 F.R. 5659; 167-38, Oct. 26, 1959, 24 F.R. 8857.

111.01 APPLICATION

111.01–1 General

111.01–1(a) The provisions of this part, with the exception of Subpart 111.90 of this part, shall, unless otherwise indicated, apply to all vessels contracted for on or after November 19, 1952. The provisions of Subpart 111.90 of this part shall apply to all vessels contracted for prior to November 19, 1952.

111.01–5 Should; meaning of

In order to have, wherever possible in this part, the identical wording contained in Section 35 of the American Bureau of Shipping Rules for the Classification and Construction of Steel Vessels, the word "should" has been used instead of "shall". Therefore, in each such instance where this word "should" is used in this part (except paragraphs 111.05–10(c), 111.05–10(d) and 111.05–10(f)) to describe, or as applicable to, the equipment or installation, this word is to be considered the same as the word "shall" in describing Coast Guard requirements.

111.05 GENERAL REQUIREMENTS

111.05–1 Construction and installation

Electrical apparatus and wiring systems shall be in accordance with the requirements of this part. The requirements of this part are applicable to all vessels but may be modified by the Commandant for vessels certificated for limited service or for vessels less than 300 gross tons. The requirements of this part are minimum requirements and it is recommended that details not covered by the regulations be in general conformity with Standard No. 45 of the Institute of Electrical and Electronic Engineers. (See paragraph 110.10–1(d) of this subchapter.)

111.05–5 Plan approval

111.05–5(a) *General.*

111.05–5(a)(1) The required plans listed in this subpart are general in character, but include all plans which normally show construction and safety features coming under the cognizance of the Coast Guard. In the case of a particular vessel, all of the plans enumerated may not be applicable, and it is intended that only those plans and specifications be submitted as will clearly show the vessel's arrangement, construction and required equipment.

111.05–5(a)(2) In the list of required plans given in this section, those indicated by an asterisk cover the electrical items necessary for the approval of the installation by the American Bureau of Shipping for vessels classed by that organization. When prints bearing record of such approval by the American Bureau of Shipping are forwarded to the Coast Guard, they will, in general, be accepted as satisfactory except insofar as the law or the regulations in this chapter contain requirements which are not covered by the American Bureau of Shipping.

111.05–5 (b) *Procedure for submittal of plans.*

111.05–5(b)(1) As the relative locations of shipyards, design offices, and Coast Guard offices vary throughout the country, no specific routing will be required in the submittal of plans. In general, one of the procedures outlined in this paragraph would apply, but in a particular case, if a more expeditious procedure can be used, there will be no objection to its adoption.

111.05–5(b)(2) The plans may be submitted to the Officer in Charge, Marine Inspection at or nearest the place where the vessel is to be built. This procedure will be most expeditious in the case of those offices where personnel and facilities are available for examination and approval of the plans locally.

111.05–5(b)(3) The plans may be submitted directly to the Commandant (MMT), U.S. Coast Guard, 1300 E Street NW., Washington, D.C. 20226. In this case, the plans will be returned directly to the submitter, with a copy of the action being forwarded to the interested Officer in Charge, Marine Inspection.

★111.05–5(b)(4) The plans may be submitted directly to field technical offices.

★111.05–5(b)(4)(i) Commander, 3d Coast Guard District (mmt), Governor's Island, New York, N.Y. 10004, for geographical area covered by 1st, 3d, and 5th Coast Guard Districts.

★111.05–5(b)(4)(ii) Commander, 8th Coast Guard District (mmt), Room 308, Customhouse, 423 Canal Street, New Orleans, La. 70130, for geographical area covered by 2d, 7th, and 8th Coast Guard Districts.

★111.05–5(b)(4)(iii) Commander, 12th Coast Guard District (mmt), 630 Sansome Street, San Francisco, Calif. 94501, for geographical area covered by 11th, 12th, 13th, 14th, and 17th Coast Guard Districts.

111.05–5(b)(5) In the case of classed vessels, upon specific request by the submitter, the American Bureau of Shipping will arrange to forward the necessary plans to the Coast Guard indicating its action thereon. In this case, the plans will be returned as noted in subparagraph (3) of this paragraph.

111.05–5(c) *Number of plans required.*

111.05–5(c)(1) Four copies of each plan are normally required so that one can be returned to the submitter. If the submitter desires additional approved plans, a suitable number should be submitted to permit the required distribution.

111.05–5(d) *Electrical plans required for new construction.*[1]

*111.05–5(d)(1) Specifications.

*111.05–5(d)(2) General arrangements.

*111.05–5(d)(3) Switchboard front, rear, end, and section views.

*111.05–5(d)(4) Switchboard wiring diagram.

*111.05–5(d)(5) Switchboard material and nameplate list.

*111.05–5(d)(6) Elementary wiring diagram of metering and automatic switchgear.

*111.05–5(d)(7) Description of operation of propulsion control and bus transfer switchgear.

*111.05–5(d)(8) Elementary (one line) wiring diagram of power system (supplemented by cable lists, panelboard summaries, etc., if desired) giving:

*111.05–5(d)(8)(i) Type and size of generators.

*111.05–5(d)(8)(ii) Type and size of generator cables, bus-tie cables, feeders, and branch circuit cables.

*111.05–5(d)(8)(iii) Power, lighting, and interior communication panelboards showing number of circuits and rating of energy consuming devices.

111.05–5(d)(8)(iv) Type and capacity of storage batteries.

111.05–5(d)(8)(v) Rating of circuit breakers and switches, interrupting capacity of circuit breakers, and rating or setting of overcurrent devices.

*111.05–5(d)(9) Electric plant summary showing connected loads and calculated operating loads for various conditions of operation.

*111.05–5(d)(10) Isometric or deck wiring plans of power system, including symbol list.

*111.05–5(d)(11) Elementary wiring diagram of steering gear alarm circuits and ventilation shutdown control.

*111.05–5(d)(12) Elementary wiring diagram and isometric or deck wiring diagrams of electric watertight door system, firescreen door holding system, and power-operated lifeboat winches.

*111.05–5(d)(13) Generators, propulsion motors, and vital auxiliary motors. Manufacturer's outline drawing of each giving nameplate data, degree of enclosure, type of insulation, temperature rise above stated ambient temperature, duty cycle, and application or name of auxiliary driven. Vital motors are those essential, or those which are part of a system that is essential, to the safe operation and navigation of the vessel. Examples of such vital auxiliary motors are propulsion auxiliary motors, steering gear motors, fire and bilge pump motors, motors driving emergency M–G sets, etc.

*111.05–5(d)(14) Motor starters. Manufacturer's enclosure outline drawing, control elementary wiring diagram, and application of each. For lifeboat winch motor starters, see Section 111.65–40.

111.05–5(d)(15) Distribution panelboards, branch boxes, enclosed switches, pushbutton stations, control switches, etc. Manufacturer's outline drawing or suitable identification on deck wiring plan symbol list. For lifeboat winch control switches, see Section 111.65–40.

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[1] The items marked with an asterisk (*) indicate such items may require the approval of the American Bureau of Shipping.

111.05–5(d)(16) Isometric or deck wiring plan of lighting feeders.

*111.05–5(d)(17) Deck plans of lighting system showing location of cables, fixtures, and wiring devices, cable sizes and types, and manufacturer's name and identification of fixtures and wiring devices. If manufacturer's name and identification are contained in a symbol list, the corresponding symbol marking should be employed on the deck plans.

111.05–5(d)(18) Elementary and isometric or deck wiring diagrams of engine order telegraph system, sound powered telephone system, general alarm system, emergency loudspeaker system, rudder angle indicator system, shaft speed indicator system, gyro compass system, gyro pilot system, radio system, radar plan position indicator system, loran system, refrigerated spaces alarm system, etc., with material identified by name of manufacturer and drawing and/or catalog number. If manufacturer's name and identification are contained in a symbol list, the corresponding symbol marking should be employed on the deck plans.

111.05–5(d)(19) Elementary and deck wiring plans of fire detecting and alarm system, manual alarm system, smoke detecting system, carbon dioxide extinguishing system alarms, and supervised patrol system, with material identified by name of manufacturer and drawing and/or catalog number. If manufacturer's name and identification are contained in a symbol list, the corresponding symbol marking should be employed on the deck plans.

111.05–5(e) *Electrical plans required for repairs and alterations of existing vessels.*

111.05–5(e)(1) No repairs or alterations affecting the safety of the vessel shall be made without the knowledge of the Officer in Charge, Marine Inspection.

111.05–5(e)(2) Drawings of alterations shall be approved before work is started unless deemed unnecessary by the Officer in Charge, Marine Inspection. The general scope of the plans shall be as noted in paragraph (d) of this section. Drawings will not be required for repairs in kind.

111.05–10 Testing and inspection

111.05–10(a) *Application.*

This section shall be applicable to all vessels, both those existing as of. November 18, 1952, and those contracted for on and after November 19, 1952.

111.05–10(b) *General.*

111.05–10(b)(1) The general requirements for inspection of vessels are contained in Part 31 of Subchapter D (Tank Vessels), Part 71 of Subchapter H (Passenger Vessels), and Part 91 of Subchapter I (Cargo and Miscellaneous Vessels) of this chapter. The contents of this section supplement the general requirements contained in other parts of this chapter.

111.05–10(b)(2) In the inspection of electrical equipment and installations, the rules promulgated by the American Bureau of Shipping respecting materials and construction, and the certificate of classification referring thereto, except when otherwise provided for by the rules and regulations of this subchapter, shall be accepted as standard.

111.05–10(b)(2)(i) The requirements of this paragraph shall not be construed to imply that ship tests or factory inspections of electrical apparatus or equipment of the types regularly conducted by the American Bureau of Shipping will be conducted by the Coast Guard. Shoptests of electrical apparatus or equipment will be conducted by the Coast Guard only when specifically required by the regulations in this chapter, or when specifically requested, either by the manufacturer, shipbuilder, owner, or the Coast Guard, and agreed to by all concerned.

111.05–10(c) *Initial inspection.*

111.05–10(c)(1) *Scope.* The initial inspection, which may consist of a series of inspections during the construction of the vessel, shall include a complete inspection of the electrical installation and electrical equipment or apparatus. The inspection shall be such as to insure that the arrangement, materials, and installations thereof, fully comply with the applicable regulations in this chapter and are in accordance with approved plans. The inspection shall also be such as to insure that the workmanship of all equipment and apparatus and the installation thereof is, in all respects, satisfactory.

111.05–10(c)(2) *Inspections required.* The specific inspections described in this paragraph are intended as suggestions to the marine inspector. It is not the intention of this paragraph to require, in the case of any particular vessel, any tests which, in the opinion of the Officer in Charge, Marine Inspection, are unnecessary.

111.05–10(c)(3) *Electric cable.* Electric cable should be checked during installation for size and type as shown on the approved plans. The adequacy of cable supports should be checked, and it should be ascertained that no cable is installed in the proximity of steam pipes or other hot objects and that the cables have not been damaged during the installation due to excessive pulling force having been applied, or due to sharp bends or sharp or rough edges of cable supports or bulkhead penetrations, etc. Cable penetrations required to be watertight should be checked for proper packing of the terminal or stuffing tubes, including provisions for future takeup of gland nuts.

111.05–10(c)(4) *Generators.* Generators should be checked for general condition, both electrical and mechanical, voltage regulation, parallel operation, operation of safety devices such as reverse-current or reverse-power trips, overcurrent trips, overspeed trips, low oil pressure trips, etc.

111.05–10(c)(5) *Rotating electrical machinery.* Rotating electrical machinery should be checked to assure that rotating and/or uninsulated electrical parts are adequately shielded from accidental contact by personnel.

111.05–10(c)(6) *Switchboards.* Switchboards should be checked for hand-rails, guardrails, working spaces, insulating floor covering, drip covers, and enclosures for backs and ends. Switchboard mounted apparatus should be checked for identifying nameplates. Circuit nameplates should be compared with the rating or setting of the overcurrent devices and with the approved plans. The accessibility of items requiring maintenance or adjustment should be checked. Meters should be checked for proper calibration. The operation of automatic switchgear and mechanical interlocks should be observed.

111.05–10(c)(7) *Motor starters.* Motor starters should be checked to assure proper starting of the motor under service conditions. A wiring diagram of each motor starter should be secured to the inside of its enclosure door. Each motor starter not completely disconnected from all sources of potential when the disconnect switch is opened (due to electrical interlocked circuits necessary for proper operation of the apparatus or for other valid reasons) should be checked to assure that attention is directed to such conditions by a suitable sign.

111.05–10(c)(8) *Disconnect switches.* The presence and location of disconnect switches required for motor starters, fuses, etc., should be checked. When a switch or circuit breaker on a switchboard or distribution panel is intended to serve as a motor and controller disconnect switch, it shall be determined that the applicable requirements of the regulations in this subchapter have been met.

111.05–10(c)(9) *Accessibility.* The accessibility of electrical apparatus for normal inspection and maintenance should be observed. The accessibility of junction boxes and the like in way of paneling should be noted during construction of a vessel. Hinged doors of motor starters and similar apparatus should be checked for interference with adjacent structural parts or apparatus.

111.05–10(c)(10) *Panelboards.* The rating or setting of the overcurrent devices should be compared with the values given on the circuit directory and with the approved plans. The accuracy of the directory description of loads served by each circuit should be checked.

111.05–10(c)(11) *Grounding.* It should be determined that metal enclosures for electrical equipment are grounded, either by the method of mounting or by ground leads. Portable equipment should be checked for grounding through the grounding conductor of the supply cable.

111.05–10(c)(12) *Emergency lighting and exit lights.* The adequacy of emergency lights and exit lights should be checked at night with all general lighting turned off.

111.05–10(c)(13) *General alarm system.* The general alarm system should be checked with a sound level meter, the sound level of the bells being measured in each stateroom for passengers or crew with doors closed. Where the background noise level is questionable, the background noise level should be measured while the vessel is underway. For the required sound levels, see Paragraph 113.25–10(c) of this subchapter.

111.05–10(c)(14) *Emergency loudspeaker system.* The emergency loudspeaker system should be checked with a sound level meter, the sound level being measured at several locations in the vicinity of each lifeboat handling station, each lifeboat embarkation station, each passenger assembly station, and throughout crew quarters. Where the background noise level is questionable, the background noise level should be measured while the vessel is underway. For the required sound levels, see Table 113.50–15 in section 113.50–15 of this subchapter. It should be demonstrated that voice reproduction is of good quality and intelligibility is of a high order. It should be demonstrated that grounding or opening either conductor or "shorting" both conductors to a typical lifeboat station loudspeaker or to a typical embarkation deck loudspeaker, each to be selected by an inspector, will not reduce the output of any one of the remaining loudspeakers by more than three decibels.

111.05–10(c)(15) *Fire detecting systems.* Fire detecting systems should be checked for compliance with the applicable regulations in this chapter and for conformance with the approved plans. Power supply circuits and thermostat circuits should be checked for supervision.

111.05–10(c)(16) *Communication systems.* All communication systems should be checked for performance and for compliance with the regulations in this chapter.

111.05–10(c)(17) *Insulation resistance.* All electric power and lighting cable and equipment should be checked for proper insulation resistance to ground and between conductors.

111.05–10(d) *Inspection for certification.*

111.05–10(d)(1) *General.* The inspection of electrical installations at the annual or biennial inspection incident to reissuance of a certificate of inspection shall include an inspection of all items enumerated in paragraph (c) of this section to the extent necessary to determine mechanical and electrical condition and performance. Particular note should be made of circuits added or modified after the initial inspection.

111.05–10(d)(2) *Fire detecting system.* Fire detecting thermostats should be tested at regular intervals (at least 25 percent of those installed tested annually) to detect any change in operating characteristics. A portable hand light with an open end sheet metal shield (such as a No. 3 fruit can) replacing the usual guard and globe would usually serve as a source of heat to operate the thermostat without damage to paint work or to the thermostat itself. Any thermostat requiring a time to operate materially different from the average when covered with the heating device should be suspected of being defective and forwarded to Coast Guard Headquarters for further testing.

111.05–10(d)(3) *Vital machinery.* Motors, motor starters and control switches used with machinery vital to the safety or propulsion of the vessel should be examined visually and opened for closer inspection when there is evidence of deterioration.

111.05–10(d)(4) *Storage batteries.* Storage batteries used for emergency lighting, diesel-engine-driven emergency generator starting, general alarm, etc., should be checked for capacity. Storage batteries supplying emergency lighting should be required to carry the connected loads for the prescribed length of time.

111.05–10(e) *Repairs or alterations.* An inspection, either general or partial, depending upon the circumstances, shall be made whenever any important repairs or alterations are undertaken.

111.05–15 General considerations

111.05–15(a) *General.*

111.05–15(a)(1) Electrical installations on vessels shall be such that: (i) services essential for safety will be maintained under various emergency conditions; and (ii) the safety of passengers, crew, and vessel from electrical hazards will be assured.

111.05–15(a)(2) Electrical equipment should be so placed or protected as to minimize the possibility of mechanical injury or damage from the accumulation of dust, oil vapors, steam, or dripping liquids. Apparatus liable to arc should be ventilated or placed in ventilated compartments in which flammable gases, acid fumes, and oil vapors cannot accumulate. Skylights and ventilators are to be so arranged as to avoid the possibility of flooding the apparatus.

111.05–15(b) *Protection from bilge water.*

111.05–15(b)(1) All generators, motors, and electric couplings are to be so arranged that they cannot be damaged by bilge water, and if necessary a watertight coaming should be provided to form a well around the base of such equipment with provisions for removing water from the well.

111.05–15(c) *Accessibility.*

111.05–15(c)(1) The design and arrangement of electrical apparatus should provide accessibility to parts requiring inspection or adjustment. Armature and field coils, rotors and revolving fields should be removable, and where air ducts are used there should be means of access.

111.05–15(d) *Watertight equipment.*

111.05–15(d)(1) All electrical equipment exposed to the weather or located in spaces where they would be exposed to seas, splashing, or other severe moisture condition, shall be of the watertight type or be protected by means of watertight enclosures which shall be such as to prevent the exposure of the equipment to temperatures in excess of those for which they have been designed.

111.05–15(e) *Corrosion-resistant parts.*

111.05–15(e)(1) Enclosures, working and other parts of electrical equipment which would be damaged or rendered ineffective by corrosion shall be made of corrosion-resistant materials or of material rendered adequately corrosion resistant.

111.05–15(f) *Grounding of permanent equipment.*

111.05–15(f)(1) All exposed metal parts of electrical machines or equipment which are not intended to be "live," but are liable to become "live" under fault conditions, shall be grounded and all electrical apparatus shall be so constructed and so installed that danger of injury in ordinary handling shall not exist.

111.05–15(f)(2) Metal frames of all

portable lamps, tools, and similar apparatus supplied as ship's equipment and rated 30 volts or more alternating current or 50 volts or more direct current shall be grounded through a suitable conductor in the supply cable.

111.05–15(g) *Means for ground detection.*

111.05–15(g)(1) Adequate means for ground detection for ships' power and lighting systems and distribution systems isolated from the ships' power and lighting systems by transformers or motor-generator sets shall be provided.

111.05–15(g)(2) If lamps are used for ground detection they shall have a rating of not more than 25 watts nor less than 5 watts operating at approximately one-half voltage in the absence of grounds.

111.05–15(g)(3) For dual-voltage, grounded-neutral, alternating current distribution systems, an ammeter shall be provided to indicate current flowing in the ground connection. The ammeter shall have a full scale range of 10 amperes. An ammeter switch of the spring return to "on" (ammeter read) type shall be provided. Where the ammeter is located remote from the ground connection and a current transformer is used, a suitable protective device shall be provided near the current transformer to prevent high voltage in the event of an open circuit. The ammeter and associated equipment shall be capable of sustaining without damage the maximum fault current available.

★111.05–15(h) *Limitations of porcelain use.* Porcelain should not be used for lamp sockets, switches, receptacles, fuse blocks, etc., where the material is rigidly fastened by machine screws or the equivalent.

111.05–20 Temperature ratings

111.05–20(a) In the requirements of this subchapter, except as noted in paragraph (b) of this section, an ambient temperature of 40° C has been assumed for all locations except boiler and enginerooms, while for these latter spaces 50° C has been assumed as the ambient temperature. Where the ambient temperature is in excess of these values, the total temperature specified shall not be exceeded. Where equipment has been rated on ambient temperatures less than those contemplated, consideration will be given to the use of such equipment provided the total temperature for which the equipment is rated will not be exceeded.

111.05–20(b) For the assumed ambient temperature for lighting fixtures, see Subparagraph 111.60–35(c)(2). For the assumed ambient temperature for thermal trip circuit breakers, see Subparagraph 111.55–15(e)(6).

111.05–25 Nature of electrical supply

111.05–25(a) *Standard systems.* The following systems of distribution are recognized as standard:

111.05–25(a)(1) Two-wire with direct current or single-phase alternating current;

111.05–25(a)(2) Three-wire with direct current or single-phase alternating current;

111.05–25(a)(3) Three-wire, three-phase alternating current; and,

111.05–25(a)(4) Four-wire, three-phase alternating current.

111.05–25(b) *Standard voltages.* The voltages given in Table 111.05–25(b) are recognized as standard.

TABLE 111.05–25(b)—*Standard voltages.*

Equipment	Direct current (volts)	Alternating current (volts)
Lighting	115	115.
Power	115 and 230	115, 220, and 440.
Generators	120 and 240	120, 230, and 450.
Propulsion	1,000 maximum	7,500 maximum.

111.05–25(c) *Standard frequency.* A frequency of 60 cycles per second is recognized as standard for alternating-current lighting and power systems.

111.05–25(d) *Others.* Special consideration will be given to systems, voltages, or frequencies differing from the recognized standard.

★111.05–30 Insulation materials

111.05–30(a) *Class designation.* Insulation material referred to in this subchapter is designated by class as described in this section.

111.05–30(b) *Class O insulation.* Materials or combinations of materials such as cotton, silk, and paper without impregnation.[1]

111.05–30(c) *Class A insulation.* Materials or combinations of materials consisting of (1) cotton, silk, paper, and similar organic materials when either impregnated [1] or immersed in a liquid dielectric; (2) molded and laminated materials with cellulose filler, phenolic resins, and sheets of cellulose acetate and other cellulose derivatives of similar properties and (3) varnishes (enamels) as applied to conductors. (ASA–C50.)

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[1] Insulation is considered to be "impregnated" when a suitable substance provides a bond between components of the structure and also a degree of filling and surface coverage sufficient to give adequate performance under the extremes of temperature, surface contamination (moisture, dirt, etc.), and mechanical stress expected in service. The impregnant must not flow or deteriorate enough at operating temperature so as to seriously affect performance in service.

111.05–30(d) *Class B insulation.* Materials or combinations of materials such as mica, asbestos, fiberglass, and similar inorganic materials in built-up form with organic binding substances. A small proportion of Class A material may be used for structural purposes only. Fiberglass or asbestos magnetic wire insulation are included in this temperature class. These may include supplementary organic materials, such as polyvinylacetal or polyamide films. (ASA–C50.)

111.05–30(e) *Class C insulation.* Materials consisting entirely of mica, porcelain, glass, quartz, and similar inorganic materials. (ASA–C50.)

111.05–30(f) *Class F insulation.* A Class F insulation system is one which by experience or accepted test can be shown to have suitable thermal endurance when operating at the limiting Class F temperature specified in the temperature rise standard for the machine under consideration. Typical materials used in a Class F system include mica, glass fiber, asbestos and other materials, not necessarily inorganic, with compatible bonding substances having suitable thermal stability. (NEMA Publication No. MG1.)

111.05–30(g) *Class H insulation.* Materials or combinations of materials consisting of (1) mica, asbestos, fiberglass, and similar inorganic materials in built-up form with binding substance composed of silicone compounds, or materials with equivalent properties; (2) silicone compounds in rubbery or resinous forms, or materials with equivalent properties. A minute proportion of Class A material may be used only where essential for structural purposes during manufacture. (ASA–C50.)

111.10 GENERATORS

111.10–1 Power requirements

111.10–1(a) *Propulsion.*

111.10–1(a)(1) The power for the main propulsion equipment may be derived from a single generator.

111.10–1(b) *Ship's service.*

111.10–1(b)(1) All ocean vessels using electricity for ship's service power or light shall be provided with at least 2 ship's service generating sets. The capacity of the generating sets shall be sufficient to carry the necessary sea load under normal operation with any 1 generating set in reserve.

111.10–1(c) *Emergency power and lighting.* See Part 112 of this subchapter for requirements.

111.10–5 Prime movers

111.10–5(a) In general, compliance of prime movers with the rules promulgated by the American Bureau of Shipping will be considered as satisfactory evidence of structural and operational efficiency of prime movers.

111.10–5(b) Special consideration will be given to the structural and operational features of prime movers for small vessels or of unusual design not contemplated by the rules of the American Bureau of Shipping.

111.10–10 Excitation

111.10–10(a) *General.*

111.10–10(a)(1) Direct-current rotating exciters shall conform to all the applicable requirements for direct-current generators.

111.10–10(b) *Propulsion.*

111.10–10(b)(1) Separately excited propulsion generators should be provided with more than 1 means of excitation. Exciters may be either direct connected or independent generating sets. Current may be derived from the ship's service power or lighting sets.

111.10–15 Generator construction

111.10–15(a) *General.*

111.10–15(a)(1) In general, compliance of generators with the rules promulgated by the American Bureau of Shipping will be considered as satisfactory evidence of the structural efficiency of generators.

111.10–15(a)(2) Special consideration will be given to the construction of generators for small vessels or of unusual design not contemplated by the rules of the American Bureau of Shipping.

111.10–15(b) *Circulating currents.*

111.10–15(b)(1) Means shall be provided to prevent circulating currents from passing between the journal and the bearing, where the design and arrangement of the machine is such that damaging current may be expected.

111.10–15(c) *Moisture condensation prevention.*

111.10–15(c)(1) When the weight of the generator excluding the shaft is over 1,000 pounds, it should be provided with means to prevent moisture condensation in the machine when idle. Where steam heating coils are installed for this purpose, there are to be no pipe joints inside the casings.

111.10–15(d) *Terminal arrangement.*

111.10–15(d)(1) All generator terminals should be protected against accidental contact, mechanical damage, and where necessary, against dripping moisture by drip shields or dripproof enclosures. Where cables enter dripproof enclosures from the sides or top, they should be provided with terminal tubes.

111.10–15(e) *Nameplates.*

111.10–15(a)(1) All generators shall be fitted with nameplates of corrosion-resistant material marked with the following information:

111.10–15(e)(1)(i) Manufacturer's type and frame designations.

111.10–15(e)(1)(ii) Output.

111.10–15(e)(1)(iii) Kind of rating.

111.10–15(e)(1)(iv) Temperature rise at rated load.

111.10–15(e)(1)(v) Design ambient temperature.

111.10–15(e)(1)(vi) Revolutions per minute at rated load.

111.10–15(e)(1)(vii) Voltage.

111.10–15(e)(1)(viii) Amperes at rated load; and,

111.10–15(e)(1)(ix) Type of windings for direct-current machines.

111.10–15(e)(2) For alternating-current generators, in addition to the applicable parts listed in subparagraph (1) of this paragraph, the following information shall be set forth:

111.10–15(e)(2)(i) Number of phases.

111.10–15(e)(2)(ii) Frequency.

111.10–15(e)(2)(iii) Power factor.

111.10–15(e)(2)(iv) Exciter voltage; and,

111.10–15(e)(2)(v) Exciting current in amperes at rating.

111.10–15(f) *Temperature detectors.*

111.10–15(f)(1) Alternating-current generators of 500 kva and above, when access to coils is difficult, and all alternating-current propulsion generators, should be provided with means for obtaining the temperatures of the stationary windings. The temperature should be indicated at a convenient location, preferably the control panel.

111.10–15(g) *Ventilation and protection.*

111.10–15(g)(1) Propulsion and ship's service generators not enclosed ventilated shall have all openings protected with substantial wire or mesh screen to prevent personnel injury, and shall be provided with protection against dripping liquids equivalent to that of a drip-proof machine.

111.10–15(g)(2) Where the protection of the generator is not the equivalent of a protected machine as defined in Paragraph 110.15–175(h) of this subchapter, the arrangement will require specific approval for each installation.

111.10–15(g)(3) Dampers shall be provided in ventilation air ducts except where recirculating systems are used.

111.10–15(h) *Fire extinguishing.*

111.10–15(h)(1) Fire extinguishing systems suitable for fires in electrical equipment are to be fitted to propulsion generators which are enclosed or in which the air gap is not directly exposed. See Part 34 of Subchapter D (Tank Vessels), Part 76 of Subchapter H (Passenger Vessels) and Part 95 of Subchapter I (Cargo and Miscellaneous Vessels) of this chapter for details of the systems.

111.10–15(i) *Insulation of windings.*

111.10–15(i)(1) Armature and field coils should be treated to resist oil and water.

111.10–15(j) *Lubrication.*

111.10–15(j)(1) *Ship's service generators.* In general, all generators should be located with their shafts in a fore and aft direction on the vessel and they must lubricate and operate satisfactorily when permanently inclined to an angle of 15 degrees athwartship and 5 degrees fore and aft; the bearings are to be so arranged that they will not spill oil under a momentary roll of 30 degrees. Where it is not practicable to mount the generators with armature shafts in the fore and aft direction, their lubrication will require special consideration. Generators depending on forced lubrication, unless otherwise approved, should be provided with means to shut down their prime movers automatically on failure of the lubricating system. Provision is to be made to prevent oil or oil vapor from passing into the machine windings.

111.10–15(j)(2) *Emergency generators.* For lubrication of emergency diesel-driven generator sets also see Subpart 112.50 of this subchapter.

111.10–20 Voltage regulation

111.10–20(a) *Ship's service generator.*

111.10–20(a)(1) Ship's service generator's inherent voltage regulation characteristics shall comply in general with all the applicable requirements contained in Table 111.10–20(a)(1).

111.10–20(a)(2) Generators shall, where practicable, be tested with their own driving units. When tested with temporary driving units, allowance shall be made for the expected speed regulation of the driving units to assure satisfactory voltage regulation, as given in Table 111.10–20(a)(1) after assembly with the permanent driving units.

111.10–20(a)(3) Where automatic voltage regulators are not supplied the d-c ship's service generators should be approximately flat compounded except that, if the load fluctuation does not interfere with the operation of vital auxiliaries, shunt wound generators without voltage regulators or stabilized shunt wound machines may be used.

111.10–20(a)(4) In general a separate regulator should be supplied for each alternating current generator. When it is intended

TABLE 111.10–20(a) (1)—*Generator voltage regulation.*

Type of generator	Load variation	Voltage variation (maximum)
Direct-current shunt or stabilized shunt wound generator.	100 percent to 20 percent (decreasing). 20 percent to 100 percent (increasing)	8 percent voltage rise. 12 percent voltage drop.
Direct-current compound wound generator and direct-current shunt wound generator with voltage regulator.	20 percent to 100 percent (increasing)	2½ percent.
	20 percent to 100 percent (increasing) 100 percent to 20 percent (decreasing)	3 percent from average of ascending and descending curves.
Direct-current 3-wire generator (In addition to the above).	Rated current on either positive or negative and 25 percent rated current on neutral and rated voltage positive to negative	Negative to neutral and positive to neutral 2 percent of rated positive to negative voltage.
Alternating-current generator and regulator (no reactive droop compensation).	0 percent to 100 percent (increasing) 100 percent to 0 percent (decreasing) (At rated power factor)	1 percent of rated voltage from a median value halfway between highest and lowest values attained.[1]
Two or more alternating-current generators and regulators with reactive droop compensation adjusted for a voltage droop of not more than 4 percent of rated voltage for a reactive load change from 0 percent to 60 percent of continuous kilovolt-ampere rating.	0 percent to 100 percent (increasing) 100 percent to 0 percent (decreasing) (At rated power factor)	Not more than 4 percent droop and no point more than 1 percent of rated voltage from the average curve drawn through a plot of settled voltage versus load for any increasing or decreasing load between zero and full load.

[1] May be 2½ percent for emergency generator.

that two or more generators will be operated in parallel, reactive droop compensating means should be provided to divide the reactive power properly between the generators. The regulator in conjunction with the exciter and the generator characteristics should be capable of performing in accordance with conditions set forth in this section.

111.10–25 Parallel operation

111.10–25(a) In general, when the installation is such that two or more generators are to be operated in parallel, the load on any generator should not differ more than plus or minus 15 percent of its rated kilowatt load from its proportionate share, based on the generator ratings, of the combined load for any steady state condition in the combined load between 20 percent and 100 percent of the sum of the rated loads of all generators. The starting point for the determination of the foregoing load distribution requirements should be at 75 percent load with each generator carrying its proportionate share.

111.10–30 Temperature Limitations

111.10–30(a) Generators shall be designed for an ambient temperature of 50° C. When tested in accordance with American Standard C50, the temperature rises shall not exceed the values given in Tables 111.10–30(a1) and 111.10–30(a2). Where provisions are made for insuring an ambient temperature of 40° C. or less, the temperature rises may be 10° C. higher than the values given in the tables.

★TABLE 111.10–30(a1)—*Limits of temperature rises for direct-current generators based on 50° C. ambient temperature* [1]

Part of generator	Limits of temperature rises—degrees centigrade (measured by thermometer) [2] [3]					
	Class A insulation		Class B insulation		Class H insulation	
	Continuous	At end of 2-hour overload	Continuous	At end of 2-hour overload	Continuous	At end of 2-hour overload
All insulated windings other than items next following	40	55	60	75	80	105
Single-layer field windings with exposed uninsulated surfaces and bare copper windings	50	65	70	85	100	125
Cores and mechanical parts in contact with or adjacent to insulation	40	55	60	75	80	105
Commutator and collector rings	55	65	75	85	95	115
German silver or grid shunts on series field windings	175	----------	175	----------	(1)	----------
Bearings	35	----------	40	----------	(1)	----------

[1] Special consideration shall be given to other parts of the machine such as bearings, etc.

[2] Where other methods are used refer to ASA-C-50 for temperature rise limits.

[3] For Class F insulation refer to NEMA-MG1.

★TABLE 111.10–30(a2)—*Limits of temperature rises for alternating-current generators based on 50° C. ambient temperature* [1] [2]

Item	Determined by—	Limits of temperature rises, degrees centigrade [3]					
		Salient pole generators			Turbine type generators		
		Class A insulation	Class B insulation	Class H insulation	Class A insulation	Class B insulation	Class H insulation
Armature windings of machines of 1,500 kva. and less.	Thermometer	40	60	100	------	------	------
Armature windings of machines of 750 kva. and less.	do	------	------	------	40	60	100
Armature windings with 2 coil sides per slot in stators of machines above 1,500 kva.	Imbedded detector	50	70	110	------	------	------
Armature windings with 2 coil sides per slot in stators of machines above 750 kva.	do	------	------	------	50	70	110
Insulated field windings	Resistance	50	70	110	------	80	120
Collector rings	Thermometer	55	75	115	55	75	115
Cores and mechanical parts in contact with or adjacent to insulation.	do	40	60	100	40	60	100
Bearings	do	35	40	(2)	35	40	(2)

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[1] For generators having 25 percent overload rating for 2 hours, the temperature at the end of the overload run when conducted immediately following the continuous run shall not exceed the figures in the table by more than 15° C. except for collector rings which shall be in accordance with the table.

[2] Special consideration shall be given to other parts of the machine such as bearings, etc.

[3] For Class F insulation, refer to NEMA–MG1.

111.10–35 Dielectric strength of insulation

111.10–35(a) Generators shall be capable of withstanding without damage a dielectric test in accordance with American Standard C50.

111.10–40 Tests

111.10–40(a) Sufficient tests should be made by the manufacturer to insure that the machine is in accordance with these regulations.

★111.15 STORAGE BATTERIES

111.15–1 General requirements

111.15–1(a) *Power and light batteries.* Power and lighting batteries may be of the lead acid or alkaline type, or any other approved type, due consideration being given to suitability for any specific application. The cells shall be constructed so as to prevent spilling of electrolyte due to an inclination of 40° from the normal.

111.15–1(b) *Emergency and general alarm storage batteries.* When batteries are used for emergency lighting and power loads or for general alarm system loads, the requirements of Part 112 of this subchapter are also applicable.

111.15–1(c) *Categories.* Batteries shall be classified into three types depending upon power output of the battery charger.

111.15–1(c)(1) *Large.* Large batteries shall be considered those connected to a battery charger whose output is more than 2 kw. (calculated from the maximum obtainable charging current and the normal voltage of the battery).

111.15–1(c)(2) *Moderate.* Moderate batteries shall be considered those connected to a battery charger whose output is between 0.2 kw. and 2 kw. (calculated from the maximum obtainable charging current and the normal voltage of the battery).

111.15–1(c)(3) *Small.* Small size batteries shall be considered those connected to a battery charger whose output is less than 0.2 kw. (calculated from the maximum obtainable charging current and the normal voltage of the battery).

111.15–1(d) *Nameplates.* Each tray shall be provided with a durable nameplate securely attached, bearing the manufacturer's name or trade mark and type designation, the ampere-hour rating at a specific rate of discharge, and the specific gravity of the electrolyte (for a lead acid battery when fully charged). Data molded on the tray case will be acceptable in lieu of a nameplate.

111.15–5 Battery installation

111.15–5(a) *Large storage batteries.* Large batteries should be installed in a room assigned to batteries only, but may be installed in a box on deck if a room is not available. Lighting equipment installed in a battery room shall be explosion proof suitable for Class I, Group D, locations. Devices liable to arc, such as switches, battery chargers, etc. shall not be installed in battery rooms. The overload protective device required by Section 111.15–25 should be placed in each conductor adjacent to but outside the room. Electric cables other than those serving the battery or battery room lighting should be routed around rather than through the battery room.

111.15–5(a)(1) A "danger notice" shall be permanently secured to the doors of the battery room or to the covers of battery deck boxes indicating that a naked light or smoking in these rooms or in this vicinity is prohibited.

111.15–5(b) *Batteries of moderate size.* Batteries of moderate size as described in Subparagraph 111.15–1(c)(2) should preferably be installed in a battery room or in a box on deck, but may also be installed in a box or locker in some suitable space such as an engineroom, storeroom, etc., or may be installed open if protected from above from falling objects in the engineroom or in a similar well-ventilated compartment. Batteries should not be installed in sleeping spaces. Engine cranking batteries should be located as closely as possible to the engine or engines served.

111.15–5(c) *Batteries of small size.* Batteries of small size as described in Subparagraph 111.15–1(c)(3) may be installed in such places as open working spaces and boat engine compartments provided that the space is ventilated.

111.15–6 Arrangement

111.15–6(a) *Battery trays.* Battery trays should be chocked with wood strips or equivalent to prevent movement and each tray should be fitted with nonabsorbent insulating supports on the bottom and with similar spacer blocks at the sides or with equivalent provisions to secure air circulation space all around each tray. Battery trays should be so arranged that the trays are accessible and with not less than 10 inches head room.

111.15–6(b) *Tiers.* When batteries are arranged in two or more tiers, all shelves should have not less than 2 inches space front and back for circulation of air.

111.15–10 Ventilation

111.15–10(a) *General.* All rooms, lockers, and boxes for storage batteries should be arranged or ventilated to avoid accumulation of flammable gas.

111.15–10(b) *Battery rooms.* Natural ventilation may be employed if ducts can be run directly from the top of the room to the open air above with no part of the duct more than 45° from the vertical. These ducts should not contain appliances (e.g., flame arresters) which may impede the free passage of air or gas mixtures. Rooms containing large battery banks as defined in Subparagraph 111.15–1(c)(1) shall be ventilated by mechanical exhaust. When mechanical exhaust is required, the system shall be separate from ventilation systems for other spaces, and, if electric, the motor shall be located outside the battery room. Mechanical ventilation systems shall be interlocked with the battery charger so that the battery cannot be charged without ventilation. Adequate openings, whether connected to ducts or not, for air inlet shall be provided near the floor or the bottom of lockers or boxes. In every case the quantity of the air expelled should be at least equal to:

$$(q=3.89\ in.) \qquad (1)$$

where:

q=quantity of expelled air in cubic feet per hour.

i=maximum charging current during gas formation, however at least one-fourth of the maximum obtainable charging current of the charging facility.

n=number of cells.

111.15–10(c) *Battery lockers.* Battery lockers should be ventilated, if practicable, similarly to battery rooms by a duct led from the top of the locker to the open air or to an exhaust ventilation duct, but the duct may terminate not less than 3 feet above the top of the locker in machinery spaces and similar well-ventilated compartments. Louvers or equivalent should be provided near the bottom for entrance of air.

111.15–10(d) *Deck boxes.* Deck boxes should be provided with a duct from the top of the box terminating at least 4 feet above in a gooseneck, mushroom head, or equivalent to prevent entrance of water. Holes for air inlet should be provided on at least two opposite sides of the box. The entire deck box, including openings for ventilation, should be weathertight to prevent entrance of spray or rain.

111.15–10(e) *Boxes for small batteries.* Boxes for small batteries require no ventilation other than openings near the top to permit escape of gas.

111.15–15 Protection from corrosion

111.15–15(a) Shelves in battery rooms or lockers for acid batteries should have a watertight lining of sheet lead of $\frac{1}{16}$-inch thickness carried up not less than 3 inches on all sides. For alkaline batteries the shelves should be similarly lined with steel not less than $\frac{1}{32}$-inch thick. Alternatively, a battery room may be fitted with a watertight lead pan for acid batteries, steel for alkaline batteries, over the entire deck, carried up not less than 6 inches on all sides. Deck boxes should be lined in accordance with the above alternative method. Boxes for small batteries should be lined to a depth of 3 inches consistent with the methods described above.

111.15–15(b) Alternate lining materials may be used in lieu of lead or steel if it can be established that the material is corrosion-resistant to the specified electrolyte used in the batteries.

111.15–20 Conductors

111.15–20(a) When conductors enter battery rooms the holes shall be made watertight. All connections within battery rooms shall be resistant to the electrolyte. Cables shall be sealed to resist the entrance of electrolyte by spray or creepage. The size of the connecting cable is to be based on current-carrying capacities given in Table 111.60–1(e)(1)(i) and the starting rate of charge or maximum discharge rate, whichever is the greater, shall be taken into consideration in determining the cable size.

111.15–25 Overload and reverse current protection

111.15–25(a) An overload protective device shall be placed in each battery conductor, except that engine cranking batteries and batteries with a nominal potential of 6 volts or less need not be protected against overload. For location of overcurrent devices with regard to battery rooms, see paragraph 111.15–5(a).

111.15–25(b) The charging equipment (except when a rectifier is employed) for all batteries with a nominal voltage more than 20 percent of line voltage shall provide automatic protection against reversal of current.

111.20 TRANSFORMERS

111.20–1 General requirements

111.20–1(a) All transformer windings should be treated to resist moisture, sea atmosphere, and oil vapors.

111.20–5 Temperature rise

111.20–5(a) The temperature rise, based on an ambient temperature of 40° C., shall not exceed the following: Class A insulation, 55° C.; Class B insulation, 80° C.; Class H insulation, 150° C.

111.20–5(b) If the ambient temperature exceeds 40° C. the transformer shall be derated so that the total temperature given in this section is not exceeded. Temperatures are to be taken by the resistance method of temperature determination.

111.25 MOTORS

111.25–1 General requirements

111.25–1(a) The requirements for generators contained in paragraphs 111.10–15 (a), (b), (c), (f), (g), (h), (i), and (j) are also applicable to motors, except that paragraphs 111.10–15 (c), (f) and (h) are applicable to propulsion motors only.

111.25–5 Nameplates

111.25–5(a) All motors shall be fitted with nameplates of corrosion-resistant material. The nameplates shall be marked with the following information:

111.25–5(a)(1) Manufacturer's type and frame designation;

111.25–5(a)(2) Output (hp.);

111.25–5(a)(3) Kind of rating;

111.25–5(a)(4) Design ambient temperature;

111.25–5(a)(5) Temperature rise at rated load;

111.25–5(a)(6) Revolutions per minute at rated load;

111.25–5(a)(7) Voltage;

111.25–5(a)(8) Amperes at rated load; and,

111.25–5(a)(9) Type of winding (for direct-current machines).

111.25–5(b) For alternating-current motors in addition to the applicable parts listed in paragraph (a) of this section, the nameplates shall be marked with the following information:

111.25–5(b)(1) Number of phases;

111.25–5(b)(2) Frequency;

111.25–5(b)(3) Power factor (synchronous motors only);

111.25–5(b)(4) Exciter voltage (synchronous motors only);

111.25–5(b)(5) Exciter current (synchronous motors only);

111.25–5(b)(6) Secondary voltage (polyphase wound-rotor induction motors only);

111.25–5(b)(7) Secondary amperes at rated load (polyphase wound-rotor induction motors only);

111.25–5(b)(8) For motors rated at ½ horsepower or larger, except a polyphase wound-rotor motor, a code letter to show its input in kilovolt-amperes with locked rotor selected from Table 111.25–5(b)(8); and,

111.25–5(b)(9) For multispeed motors, amperes at rated load for each winding or winding connection.

111.25–5(c) For nonvital motors, such as winch motors, refrigeration motors, water cooler motors, galley appliance motors, etc., nameplates with standard commercial markings

Table 111.25–5(b)(8)—*Locked rotor indicating code letters*

Code letter	KVA per hp. with locked rotor
A	0 - 3.14
B	3.15- 3.54
C	3.55- 3.99
D	4.0 - 4.49
E	4.5 - 4.99
F	5.0 - 5.59
G	5.6 - 6.29
H	6.3 - 7.09
J	7.1 - 7.99
K	8.0 - 8.99
L	9.0 - 9.99
M	10.0 -11.19
N	11.2 -12.49
P	12.5 -13.99
R	14.0 -15.99
S	16.0 -17.99
T	18.0 -19.99
U	20.0 -22.39
V	22.4 -and up

will be acceptable. Nameplates for motors located in corrosive locations shall be made of corrosion-resistant material.

111.25–10 Temperature limitations

111.25–10(a) Motors for use in the engineroom or boilerroom shall be designed for an ambient temperature of 50° C. Motors for use in locations where the ambient temperature will not exceed 40° C. may be designed for an ambient temperature of 40° C. Motors, when tested in accordance with American Standard C50, shall not exceed the limits of temperature rises given in Tables 111.25–10 (a1) and (a2).

111.25–15 Duty cycle

111.25–15(a) Motors shall be rated for continuous duty, except that motors for the applications listed in Table 111.25–15(a) may be short-time rated motors as indicated. Any other motors of similar duty may have consistent short-time ratings.

Table 111.25–15(a)

Application of motor	Minimum short time rating of motor in hour
Deck winch and direct acting capstan	½.
Deck winch with hydraulic transmission.	Continuous at no load, followed by ½ hour at full load.
Direct acting windlass	¼.
Windlass with hydraulic transmission	½ hour idle pump operation followed by ¼ hour full load operation.
Steering gear, direct acting	1.
Steering gear, indirect drive	Continuous operation at 15 percent load followed by 1 hour at full load.
Watertight door operators	1/12.
Lifeboat winches	1/12.

111.25–20 Dielectric strength of insulation

111.25–20(a) Motors shall be capable of withstanding without damage a dielectric test in accordance with American Standard C50.

★Table 111.25–10(a1).—*Limits of temperature rises for direct-current motors* [1]

Part of motor and type of enclosure	Limits of temperature rises; degrees centigrade (thermometer method) [2][3]					
	Class A insulation		Class B insulation		Class H insulation	
	40° C. ambient temperature	50° C. ambient temperature	40° C. ambient temperature	50° C. ambient temperature	40° C. ambient temperature	50° C. ambient temperature
All insulated windings other than item next following:						
Open and semienclosed	50	40	70	60	110	100
Totally enclosed	55	45	75	65	115	105
Single-layer field windings with exposed uninsulated surfaces and bare copper windings:						
Open and semienclosed	60	50	80	70	130	120
Totally enclosed	65	55	85	75	135	125
Cores and mechanical parts in contact with or adjacent to insulation:						
Open and semienclosed	50	40	70	60	110	100
Totally enclosed	55	45	75	65	--------	--------
Commutators and collector rings: All types	65	55	85	75	125	115
Bearings:						
Open and semienclosed	40	35	45	40	(1)	(1)
Totally enclosed	45	40	50	45	(1)	(1)

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[1] Special consideration shall be given to other parts of the machine, such as bearings, etc.

[2] Where other methods are used refer to ASA-C-50 for temperature rise limits.

[3] For Class F insulation refer to NEMA-MG1.

★TABLE 111.25–10(a2).—*Limits of temperature rises for alternating-current motors* [1] [2]

Part of motor and type of enclosure	Limits of temperature rises; degrees centigrade (thermometer method) [3] [4]					
	Class A insulation		Class B insulation		Class H insulation	
	40° C. ambient temperature	50° C. ambient temperature	40° C. ambient temperature	50° C. ambient temperature	40° C. ambient temperature	50° C. ambient temperature
Coil windings, cores and mechanical parts in contact with, or adjacent to insulation:						
All except totally enclosed	50	40	70	60	110	100
Totally enclosed	55	45	75	65	115	105
Collector rings, commutators (the class of insulation refers to insulation affected by the heat from the commutator or collector rings, which insulation is employed in the construction of the commutator or collector rings or is adjacent thereto): All types	65	55	85	75	125	115
Bearings:						
Open and semienclosed	40	35	45	40	(2)	(2)
Totally enclosed	45	40	50	45	(2)	(2)

[1] Squirrel-cage windings and mechanical parts not in contact with or adjacent to insulation may reach such temperatures as will not be injurious in any respect.

[2] Special consideration shall be given to other parts of the machine, such as bearings, etc.

[3] Where other methods are used refer to ASA–C–50 for temperature rise limits.

[4] For Class F insulation refer to NEMA–MG1.

111.25–25 Terminal arrangement

111.25–25(a) All motors shall be provided with terminal leads in terminal boxes secured to the frames. Terminal boxes shall be dripproof or watertight, consistent with the motor enclosure. The ends of motor terminal leads shall be fitted with connectors. As an alternate to this arrangement, the frames of motors may be fitted with terminal tubes through which the cable shall pass to suitable terminals inside the frame.

111.25–30 Enclosure and protection

111.25–30(a) *General.* Motors for use in the engineroom or spaces where subject to mechanical injury, or dripping of oil or water, shall be either of the waterproof or dripproof protected type, or they may be of the open type if protected in accordance with Paragraph 111.10–15(g). Care shall be exercised in locating motors high enough to avoid bilge water. Motors shall not be located beneath and covered by the floorplates unless otherwise approved by the Commandant.

111.25–30(b) *Pump motors.* Motors for operating plunger and close coupled pumps should have the driving end entirely enclosed or designed to prevent leakage from entering the motor.

111.25–30(c) *Motors for use on weather decks.* Motors for use on weather decks shall be of the waterproof type or shall be enclosed in waterproof housings, drained as described in Paragraph 110.15–175(k) of this subchapter.

111.25–30(d) *Motors installed below decks.* Motors installed below decks should be located in as dry a place as practicable and proximity to steam, water and oil piping should be avoided.

111.25–30(e) *Motors for hazardous locations.* Motors for use in hazardous locations shall comply with the requirements of Section 111.60–40.

111.25–35 Current ratings

111.25–35(a) For continuous duty motors, the current values given in the Table 111.25–35(a) shall be used for the purpose of determining the current-carrying capacity of conductors, switches, branch-circuit overcurrent devices, etc., in lieu of the actual current ratings marked on the motor nameplate. For multispeed motors, for motors of unusual speeds, and for other than continuous duty motors, the nameplate current values shall be used. The motor-running overcurrent protection shall be based on the motor nameplate current rating or ratings.

111.30 ELECTRIC COUPLINGS FOR PROPULSION

111.30–1 General requirements

111.30–1(a) *Enclosure and ventilation.* Electrical couplings shall be enclosed and ven-

TABLE 111.25–35(a)—*Approximate full-load currents of continuous duty motors* [1]

Motor horsepower	Full-load current—amperes					
	Direct-current motors		3-phase, alternating-current induction motors			
			Squirrel-cage		Wound-rotor	
	115 volts	230 volts	220 volts	440 volts	220 volts	440 volts
⅙	2.0	1.0	0.90	0.45	--------	--------
¼	2.6	1.3	1.16	.58	--------	--------
⅓	3.2	1.6	1.4	.70	--------	--------
½	4.5	2.3	1.9	.95	--------	--------
¾	6.5	3.3	2.6	1.3	--------	--------
1	8.5	4.3	3.4	1.7	5.4	2.7
1¼	10.5	5.3	--------	--------	--------	--------
1½	12.5	6.3	5.0	2.5	6.8	3.4
1¾	14.5	7.3	5.8	2.9	7.2	3.6
2	16.3	8.3	6.3	3.1	8.0	4.0
2½	20.5	10.3	7.6	3.8	8.8	4.4
3	23	12.3	9.0	4.5	10.5	5.3
4	31	16.0	--------	--------	--------	--------
5	40	19.8	14.5	7.2	16	8.0
6	47	23.4	17.2	8.6	18	9
7½	58	28.7	21	10.5	23	11.5
9	68	34.3	24.8	12.4	26	13
10	75	38	26	13.5	29	14.5
12½	93	47	34	17	36	18
15	112	56	40	20	42	21
17½	131	65	46	23	48	24
20	150	74	52	26	54	27
22½	167	83	58	29	60	30
25	185	92	65	32	68	34
27½	202	101	70	35	72	36
30	220	110	78	39	80	40
35	257	128	92	46	94	47
40	294	146	102	51	104	52
45	329	163	116	58	116	58
50	364	180	126	63	128	64
60	432	215	152	76	154	77
75	--------	265	188	94	188	94
100	--------	353	250	125	250	125
125	--------	440	310	155	310	155
150	--------	535	370	185	370	185
200	--------	720	490	245	490	245

[1] Table 111.25–35 (a) gives values that are approximate, and typical only of motors for usual speeds and frequencies. For low speed and special motors, the full-load currents are somewhat higher than the values shown. For this reason, the values shown should be used only for estimating purposes and the selection of cable. They should not be used in the selection of overload relay heaters and coils.

tilated as required for generators. All windings shall be specially treated to resist moisture, oil and salt air.

111.30–1(b) *Accessibility for repairs.* The couplings should be designed to permit removal as a unit without moving the engine.

111.30–1(c) *Excitation.* Excitation should be provided as for propulsion generators and motors.

111.30–1(d) *Nameplates.* All electric propulsion couplings shall be fitted with nameplates of corrosion-resistant material. The nameplates shall be marked with the following information:

111.30–1(d)(1) Manufacturer's type and frame designation;

111.30–1(d)(2) Output (hp.);

111.30–1(d)(3) Kind of rating;

111.30–1(d)(4) Design ambient temperature;

111.30–1(d)(5) Temperature rise at rated load;

111.30–1(d)(6) Revolutions per minute at rated load;

111.30–1(d)(7) Voltage;

111.30–1(d)(8) Exciter voltage; and,

111.30–1(d)(9) Exciting current in amperes at rated load.

111.30–1(e) *Temperature limitations.* The limits of temperature rise should be the same as for alternating-current generators, except that when a squirrel cage element is used the temperature of this element may reach such values as are not injurious. Depending upon the cooling arrangements the maximum temperature rise may occur at other than full load rating so that heat runs will require special consideration; for this purpose, when an integral fan is fitted the coupling temperatures should not exceed these limits when operated continuously at 70 percent of full load rpm, full excitation and rated torque.

111.35 SWITCHBOARDS AND PROPULSION CONTROLS

111.35–1 General requirements

111.35–1(a) *General.* Controlling appliances for propulsion and ship's service equipment should include the apparatus necessary for starting, stopping, reversing and controlling the speed of motors, together with essential safety devices. All wearing parts are to be readily renewable.

111.35–1(b) *Switchboard installation and location.* Switchboards shall be installed in as dry a place as possible and shall be accessible from the front and rear. Switchboards shall be secured to a solid foundation, shall clear overhead deck beams by at least 4 inches, and shall be either self-supported or braced to the bulkhead or deck above. In case the latter method is used, means of bracing shall be flexible to allow deflection of the ship's structure without buckling the control cell or assembly structure. Unless otherwise specifically approved, a clear working space of not less than 36 inches shall be provided in front of switchboards and a working space of not less than the values shown in Table 111.35–1(b) shall be provided in the rear of switchboards. In a passenger ship where there is only one main generating station, the main switchboard shall be located in the same main fire zone.

111.35–1(c) *Switchboard mechanical protection.* The sides of switchboards shall be enclosed and the space in the rear of switchboards made inaccessible to other than qualified persons. Nonconducting mats or gratings shall be provided on deck in the front and rear of

TABLE 111.35–1(b)—*Working space in rear of switchboards.*

Potential between phases or conductors of opposite polarity	Switchboard width	Clear working space in rear of switchboard in inches	
		Accessible from one end only	Accessible from both ends
250 volts or less	Single panel not exceeding 42 inches in width.	[1] 24	18
	More than one panel or single panel exceeding 42 inches in width.	[1] 30	24
Over 250 volts but less than 600 volts.	Single panel not exceeding 42 inches in width.	[1] 30	24
	More than one panel or single panel exceeding 42 inches in width.	[1] 36	30
600 volts or over	Any width	[1] 38	[1] 38

[1] May be reduced not more than 6 inches in way of stiffeners and frame or by equipment on a single panel in the switchboard.

switchboards. Nonconducting handrails at the front and nonconducting guardrails at the rear shall be provided. Each switchboard shall have a drip-cover over the top. Hinged panels of dead front switchboards shall be provided with positioners and stops.

111.35–1(d) *Switchboard construction.* Panels should be made of impregnated ebony asbestos, laminated phenolic material, or the equivalent. They may be made of metal if the live parts mounted thereon are properly insulated. The supporting framework for all panels is to be of rigid construction. No wood should be used in the construction of switchboards except that hardwood or nonconducting handrails and guardrails shall be provided for the protection of personnel from live parts.

111.35–1(e) *Dead front type switchboard.* Dead front type switchboards shall be used where the voltage between poles or to ground is above 250 volts direct current or 55 volts alternating current.

111.35–1(f) *Corrosion-resistant parts.* Parts of switchboards and control assemblies liable to damage by corrosion should be made of noncorrodible material or of material made corrosion resistant.

111.35–1(g) *Mechanical strength of working parts.* All levers, handles, handwheels, interlocks and their connecting links, shafts and bearings for the operation of switches and contactors should be of such proportions that they will not be broken or distorted by manual operation.

111.35–1(h) *Nameplates.* Nameplates shall be provided for each piece of apparatus to indicate clearly its service. Nameplates for feeders and branch circuits shall include the circuit designation, description of the load served, and the rating or setting of the overcurrent protective device.

111.35–1(i) *Protection of instrument circuits.* Except as otherwise provided in this paragraph, instruments, pilot lights, ground detector lights, potential transformers, and other switchboard devices shall be supplied by circuits protected by overcurrent devices.

111.35–1(i)(1) Circuits, the opening of which would create a hazard in the operation of the vessel, shall not be protected against overcurrent. Such circuits will usually include electric propulsion control circuits, voltage regulator supply circuits, and ship's service generator circuit breaker tripping control circuits.

111.35–1(j) *Grounding of instruments, relays, meters, and instrument transformers.* Metal cases of instruments, relays, meters, and instrument transformers and the secondary windings of instrument transformers located on switchboards shall be grounded.

111.35–5 Switchboard bus bars and wiring

111.35–5(a) *General.* Buses shall be designed on the basis of generator capacity and feeder loads. For a single generator, the generator bus shall have a capacity not less than the continuous rating of the generator plus any overload rating in excess of 30 minutes' duration. For more than one generator with all generating capacity feeding through one section of the bus, the capacity of the bus for the first generator shall be the same as for a single generator. For each subsequent generator the bus capacity shall be increased by 80 percent of the continuous rating of each added generator. The capacity of connection buses for each generator unit shall be not less than the continuous rating of the generator plus any overload rating in excess of 30 minutes' duration. All other bus bars and bus connections shall be designed for at least 75 percent of the combined full-load rated currents of all apparatus they supply, plus not less than 50 percent of the combined ratings of the spare switches or circuit breaker elements connected to the bus, except that when feeders supply one unit or any group of units in continuous operation they shall be designed for full load, and except that the capacity of feeder buses need not be greater than the generator buses that supply them.

111.35–5(b) *Bus bar rating.* Bus bar sizes shall be not less than that indicated for the ampere ratings in Table 34 (Appendix) of IEEE Standard No. 45.

111.35–5(c) *Arrangement of bus bars and wiring.* The arrangement of bus bars and wiring on the back of switchboards shall be such that all lugs are readily accessible. Soldering lugs, where used, should have a solder contact length at least 1½ times the diameter of the conductor and all nuts and connections should be fitted with locking devices to prevent loosening due to vibration.

111.35–5(d) *Spacing.* Except at switching mechanisms, contactors, pilot lights, and similar switchboard mounted equipment, the spacings in a switchboard shall be not less than those indicated in Table 111.35–5(d). Spacings at switchboard mechanisms, contactors, pilot lights, and similar switchboard mounted equipment shall conform to the requirements for the respective equipment as required by this subchapter.

TABLE 111.35–5(d)—*Switchboard spacings.*

Voltage involved	Minimum spacing in inches between live parts of opposite polarity		Minimum spacing in inches through air or over surfaces between uninsulated live-metal parts and grounded dead metal.
	Over surface	Through air	
125 or less	¾	½	½
126 through 250	1¼	¾	½
251 through 600	2	1	1

111.35–5(e) *Switchboard wiring.* Instrument and control wiring should be of the stranded type not smaller than 4,000 CM and should have flame-retarding insulation. Wiring from hinged panels should be of the extra flexible type.

111.35–10 Switchboard mounted equipment

111.35–10(a) *General.* Air circuit breaker contacts shall be kept at least 12 inches from the ship's structure unless insulation barriers are installed. For live front switchboards the clearance between current-carrying parts and base channel shall not be less than 4 inches. Voltage regulator element shall be totally enclosed. Where rheostats or other devices that may operate at high temperatures are mounted on the switchboard, they shall be naturally ventilated and so isolated by barriers as to prevent excessive temperature of copper or adjacent devices. When this cannot be accomplished the rheostat or other device shall be mounted separate from the switchboard. In general, all fuses, except for instrument and control circuits, shall be mounted on or be accessible from the front of the switchboard. All wiring on the back of boards for voltmeter, pilot and ground lamps shall be protected by fuses.

111.35–10(b) *Equipment.* Contactors, relays, switches, circuit breakers, etc., shall conform to the applicable requirements of such devices given in this subchapter.

111.35–10(c) *Connections.* The connections between a direct-current generator and the bus bars shall be in accordance with Figures 1 to 10, inclusive, Appendix, IEEE Standard No. 45. Other connections not less effective will be considered.

111.35–15 Ship's service generator and distribution switchboards

111.35–15(a) *General.* Ship's service generator and distribution switchboards must provide adequate control of the generation and distribution of electric power.

111.35–15(b) *Equipment for direct-current switchboards.* For direct-current switchboards, in addition to equipment required by Paragraph (a) of this section, there shall be provided at least the equipment listed in this paragraph.

111.35–15(b)(1) An unfused generator switch or links which will completely disconnect the generator and its circuit breaker from the bus, except when the generator circuit breaker is of the drawout type.

111.35–15(b)(2) For 2-wire machines, an ammeter for each generator and, for 3-wire machines, an ammeter for each positive and negative lead and a center zero ammeter in the ground connection at the generator switchboard. Ammeters shall be so located in the circuit as to indicate total generator current.

111.35–15(b)(3) For each 2-wire generator, a voltmeter with voltmeter switch for connecting the voltmeter to indicate generator voltage and bus voltage. Where a shore connection is installed, one of these voltmeter switches shall also provide for reading shore connection voltage.

111.35–15(b)(4) For each 3-wire generator, a voltmeter with voltmeter switch for connecting the voltmeter to indicate generator voltage, positive to negative, and bus voltage positive to negative, positive to neutral, and neutral to negative. Where a shore connection is installed, one of these voltmeter switches shall provide also for reading shore connection voltage, positive to negative, positive to neutral, and neutral to negative.

111.35–15(b)(5) A field rheostat for each generator.

111.35–15(b)(6) A pilot lamp for each generator connected between generator and circuit breaker.

111.35–15(b)(7) Adequate means for ground detection shall be provided on the ship's service generator and distribution switchboard for the following systems: ship's main power system, ship's main lighting system, and ship's emergency lighting system. When the ground detection means for these systems are ground lamps, a normally closed spring-return-to-normal switch shall be provided in the ground connection.

111.35–15(b)(8) A circuit breaker or fused switch for each shore power feeder installed, with a pilot light connected to the shore side thereof.

111.35–15(c) *Equipment for alternating-current switchboards.* For alternating-current switchboards, in addition to the equipment required by Paragraph (a) of this section, there shall be provided at least the equipment listed in this paragraph.

111.35–15(c)(1) An unfused generator switch or links which will completely disconnect the generator and its circuit breaker from the bus, except when the generator circuit breaker is of the drawout type.

111.35–15(c)(2) An ammeter for each generator with a selector switch to read the current of each phase.

111.35–15(c)(3) A voltmeter for each generator with voltmeter switch for connecting the voltmeter to read generator voltage of each phase and bus voltage of one phase; where a shore connection is installed, one of these voltmeter switches shall provide also for reading voltage of each phase of the shore connection.

111.35–15(c)(4) A synchroscope and synchronizing lamps with selector switch to provide for paralleling in any combination.

111.35–15(c)(5) Control for prime mover speed for paralleling.

111.35–15(c)(6) An indicating wattmeter for each generator arranged for parallel operation.

111.35–15(c)(7) A frequency meter with selector switch to connect to any generator.

111.35–15(c)(8) A field rheostat for each generator and each exciter.

111.35–15(c)(9) A double-pole field switch with discharge clips and resistor for each generator.

NOTE.—For generators with variable voltage exciters or rotary amplifier exciters, each controlled by a voltage regulator unit acting on the exciter field, the field switch, the discharge resistor and the generator field rheostat may be omitted.

111.35–15(c)(10) A pilot lamp for each generator connected between generator and circuit breaker.

111.35–15(c)(11) A voltage regulator complete with all accessories, including a voltage regulator functional cutout switch.

111.35–15(c)(12) Adequate means for ground detection. For details see Subparagraph (b)(7) of this section.

111.35–15(c)(13) A circuit breaker or fused switch for each shore power feeder installed, with a pilot light connected to the shore side thereof.

111.35–20 Emergency and interior communication switchboards

Emergency and interior communication switchboards, when fitted, shall comply with the applicable provisions of Subpart 111.35 and of Part 112 of this subchapter.

111.35–25 Electric propulsion control

111.35–25(a) *General.* The arrangement of bus bars and wiring on the back of propulsion control assemblies should be such that all parts, including the connections, are accessible. Adequate clearance should be provided between parts of opposite polarity and between live parts and ground to prevent arcing. All nuts and connections should be fitted with locking devices to prevent loosening due to vibration.

111.35–25(b) *Prime mover control.* Where required by the system of control, means should be provided at the control assembly for controlling the prime mover speed and for mechanically tripping the throttle valve.

111.35–25(c) *Protection.* The control assembly should be protected at the sides and back by a wire mesh, expanded metal grill, or other means if a bulkhead does not perform this function. The access doors to high voltage compartments should be interlocked to prevent opening unless the main generator field circuit is deenergized. A warning plate giving the maximum voltage inside the enclosure should be provided on all doors entering the enclosure. Where steam and oil gages are mounted on the main control assembly, provision should be made so that the steam or oil will not come in contact with the energized parts in case of leakage.

111.35–25(d) *Switches.* All switches are to be arranged for manual operation and so designed that they will not open under ordinary shock or vibration; contactors, however, may be operated pneumatically, by solenoids, or by other means in addition to the manual method which should be provided unless otherwise approved. Generator and motor switches should preferably be of the air-break type but for alternating-current systems, where they should be designed to open full load current at full voltage, oil-break switches using nonflammable liquid may be used if provided with leak-proof nonspilling tanks. Where necessary, field switches should be arranged for discharge resistors, unless discharge resistors are permanently connected across the field. For alternating-current systems, means should be provided for deenergizing the excitation circuits by the unbalance relay and ground relay.

111.35–25(e) *Interlocks.* All levers for operating contactors, line switches, field switches and similar devices should be interlocked to prevent their improper operation. Interlocks should be provided with the field lever to prevent the opening of any main circuits without first reducing the field excitation to zero, except that when the generators simultaneously supply power to an auxiliary load apart from the propulsion, the field excitation need only be reduced to a low value.

111.35–25(f) *Instruments and markings.* The necessary instruments to indicate existing conditions at all times are to be provided and mounted on the control panel convenient to the operating levers and switches. Instruments and other devices mounted on the switchboard are to be plainly labeled and the instruments provided with a distinguishing mark to indicate full load conditions. Metallic cases of all permanently installed instruments and the secondary windings of instrument transformers shall be permanently grounded.

111.35–25(g) *Locations.* Either wheelhouse or engineroom control may be used; however, when wheelhouse control is used an arrangement shall be provided whereby the propulsion equipment can also be controlled from the engineroom, except when otherwise approved for small vessels for limited service. When the equipment is arranged for control from two or more stations, a selector switch shall be provided for connecting the control circuit to the delegated station controller. This selector switch shall be interlocked to prevent transfer of the control without removing power and to prevent restarting from the incoming control station until the control is first returned to the "Off" position.

111.35–25(h) *Indicators.*

111.35–25(h)(1) When two or more control stations are provided, indicating lights should be located at each control to show the station which is in control.

111.35–25(h)(2) When two or more control stations are provided, additional indicating lights should be located at each control station, except at the engineroom control, to show whether the field circuits are energized or deenergized.

111.35–25(h)(3) A propeller shaft speed indicator should also be provided at each control station.

111.35–25(i) *Multiple units.* Systems having two or more propulsion generators or two or more motors on one propeller shaft should be so arranged that any unit may be cut out of service without preventing the operation of the remaining units.

111.35–25(j) *Ground detection and protection from electrical faults.* Ground detection together with means of protecting the propulsion generators and motors from electrical faults should be provided. For alternating-current systems, the grounding arrangement of the generator neutral should limit the current at full load voltage to not more than 20 amperes upon a fault to ground in the propulsion system. Phase unbalance and ground relays should be provided which will open the generator and motor field circuits upon the occurrence of a fault. For direct-current systems the ground detector may consist of a voltmeter or lights. Provision should be made for protection against severe overloads, excessive currents, and electrical faults likely to result in damage to the plant. Protective equipment should be capable of being so set as not to operate on the overloads or overcurrents experienced in a heavy seaway or when maneuvering.

111.35–25(k) *Features for other services.* If the propulsion generator is used for other purposes than for propulsion, such as dredging, cargo oil pumps, and other special services, overload protection in the auxiliary circuit and means for making voltage adjustments should be provided at the control board. When propulsion alternating-current generators are used for other services for operation in port, the port excitation control should be provided with a device that should operate just below normal idling speed of the generator to automatically remove excitation.

111.35–25(l) *Electric coupling control equipment.* Electric coupling control equipment should be combined with the prime mover speed and reversing control and should include a two-pole disconnect switch, short circuit protection only, ammeter for reading coupling current, discharge resistor and interlocking to prevent energizing the coupling when the prime mover control levers are in an inappropriate position.

111.35–30 Tests for switchboards and propulsion controls

111.35–30(a) Switchboards and propulsion control apparatus shall be capable of meeting the test requirements of section 35, American Bureau of Shipping Rules for the Classification and Construction of Steel Vessels.

111.40 DISTRIBUTION PANELBOARDS (SWITCHBOARD AND PANELBOARD TYPES)

111.40–1 General requirements

111.40–1(a) *Location.* Panelboards should be located in accessible positions and not in such spaces as bunkers, storerooms, cargo holds, compartments allotted alternately to passengers or cargo or locations exposed to the weather.

111.40–1(b) *Enclosure.* The enclosure of distribution panelboards shall be as follows:

111.40–1(b)(1) *Switchboard type.* Distribution panels of the switchboard type, unless installed in machinery spaces or in compartments assigned exclusively to electric equipment and accessible only to qualified personnel, shall be completely enclosed or otherwise protected against accidental contact and unauthorized operation.

111.40–1(b)(2) *Panelboard type.* Panelboards not exposed to moisture, and particularly flush mounted panelboards in way of joiner work in passenger and crew accommodations and public spaces, may be of nonwatertight construction. Elsewhere panelboards generally shall be of dripproof construction.

111.40–1(b)(3) *Watertight panelboards.* Where panelboards must be located where a watertight enclosure is necessary, the switches shall be externally operative.

111.40–1(c) *Locking.* The cabinet or enclosing case of panelboards shall be locked closed where accessible to passengers.

111.40–1(d) *Safety type.* Panelboards for the control of lighting circuits and panelboards containing voltages to ground in excess of 150 volts shall be of the safety type.

111.40–1(e) *Construction.* Switchboard type panelboards shall conform to the applicable requirements of Subpart 111.35, except that units constructed to be completely serviced from the front need not be accessible from the rear. Unspecified panelboard construction details shall conform with the requirements of Underwriters' Laboratories, Inc., Standard for Panelboards.

111.40–1(f) *Switching devices.* Panelboards for distribution to motors, appliances, lighting or other branch circuits, except general alarm circuits, shall be fitted with multipole switches or circuit breakers having a pole for each conductor. Overcurrent protection shall be provided for each ungrounded conductor of feeders and each conductor of branch circuits. For setting of overcurrent devices see Subpart 111.55. The rating of the disconnecting device shall be coordinated with the voltage and current requirements of the load, and in no case less than 30 amperes.

111.40–1(g) *Overcurrent protection of and number of overcurrent devices on one panelboard.* Not more than 60 overcurrent devices of a lighting or appliance branch circuit panelboard shall be installed in any one cabinet. Panelboards supplying lighting and appliance branch circuits and panelboards having switching devices rated at 50 amperes or less shall have overcurrent protection not in excess of 200 amperes.

111.40–1(h) *Relative arrangement of switches and fuses.* Panelboards having switches on the load side of any type of fuses shall not be installed.

111.40–1(i) *Directory.* Panelboard switching units shall be numbered and the panelboard provided with a circuit directory card and card holder. After installation the directory card shall be marked for each circuit with the circuit designation, description of load served, and the rating or setting of the appropriate overcurrent protective device.

111.45 MOTOR CIRCUITS AND CONTROLLERS

111.45–1 Motor controllers, general requirements

111.45–1(a) *Suitability.* Each controller shall be capable of starting and stopping the motor which it controls, and for an alternating-current motor shall be capable of interrupting the stalled-rotor current of the motor.

111.45–1(b) *Rating.* The controller shall have a horsepower rating, which shall not be lower than the horsepower rating of the motor, except as otherwise permitted in this paragraph.

111.45–1(b)(1) For a stationary motor rated at one-eighth horsepower or less that is normally left running and is so constructed that it cannot be damaged by overload or failure to start, such as clock motors and the like, the branch circuit overcurrent device may serve as the controller.

111.45–1(b)(2) For stationary motors rated at 2 horsepower or less, and 300 volts or less, the controller may be a general use switch having an ampere rating at least twice the full load current rating of the motor.

111.45–1(b)(3) For portable motors rated at one-third horsepower or less, the controller may be an attachment plug and receptacle.

111.45–1(b)(4) A branch circuit circuit breaker, rated in amperes only, may be used as a controller. When this circuit breaker is also used for overcurrent protection, it shall conform to the appropriate provisions of this part governing overcurrent protection.

111.45–1(c) *Need not open all conductors.* Except when the motor controller serves also as a disconnecting means (see Paragraph 111.45–30(1) the controller need not open all conductors to the motor.

111.45–1(d) *In grounded conductors.* One pole of the controller may be placed in a permanently grounded conductor provided the controller is so designed that the pole in the grounded conductor cannot be opened without simultaneously opening all conductors of the circuit.

★111.45–1(e) *Adjacent to motor and driven machinery.* Generally a controller shall be located adjacent to the motor and its driven machinery. Where it is desired to group motor controllers at a central location or where, for other reasons, it is not feasible to locate a controller adjacent to the motor and its driven machine, the installation shall comply with one of the conditions listed in this paragraph.

111.45–1(e)(1) The motor and controller disconnecting means required by section 111.45–30 shall be capable of being locked in the open circuit position. However, if the disconnecting means is not within sight of the controller location or is more than 50 feet distant from the controller, subparagraph (2) or (3) of this paragraph shall be complied with.

111.45–1(e)(2) A manually operable switch which will disconnect the motor from its source of supply shall be provided adjacent to the motor location. This switch shall be rated in accordance with the appropriate requirements of section 111.45–30.

111.45–1(e)(3) A maintaining type switch in the motor control circuit shall be provided adjacent to the motor which will prevent the motor from being energized.

111.45–1(f) *Number of motors served by each controller.* Each motor shall be provided with an individual controller, except that for motors of 600 volts or less, a single controller may serve a group of motors under any one of the conditions covered in this paragraph.

111.45–1(f)(1) If a number of motors drive several parts of a single machine or piece of apparatus.

111.45–1(f)(2) If a group of motors is under the protection of one overcurrent device as permitted in Subparagraph 111.45–20(c)(1).

111.45–1(g) *Adjustable-speed motors.* Adjustable-speed motors, if controlled by means of field regulation, shall be so equipped and connected that they cannot be started under weakened field, unless the motor is designed for such starting.

111.45–1(h) *Speed limitation.* Machines of the types listed in this paragraph shall be provided with speed limiting devices, unless the inherent characteristics of the machine, the system, or the load and the mechanical connection thereto are such as safely to limit the speed, or unless the machine is always under the manual control of a qualified operator.

111.45–1(h)(1) Separately excited direct-current motors.

111.45–1(h)(2) Series motors.

111.45–1(h)(3) Motor-generators and converters which can be driven at excessive speed from the direct-current end, as by reversal of current or decrease in load.

111.45–1(i) *Enclosure.*

111.45–1(i)(1) *General.* All controlling apparatus, except as otherwise permitted below, shall be protected by enclosing cases, either dripproof or watertight, depending on their location. Cable entrance plates shall be provided on enclosing cases having a volume exceeding 200 cubic inches. Cable entrance plates for watertight enclosures and at the top of dripproof enclosures shall be at least ⅛ inch thick and be fitted with gaskets. Watertight enclosures shall be provided with external feet or lugs for mounting.

111.45–1(i)(2) *Open type.* Control apparatus may be of the open type provided it is located in a compartment or enclosure assigned solely to electrical control equipment and accessible only to qualified persons. Where the compartment is used for other apparatus and the location of an open controller is such that it is subject to accidental contact, adequate guardrails or the equivalent shall be provided.

111.45–1(j) *Hinged doors.* All controller hinged doors having either a height exceeding 45 inches or a width exceeding 24 inches shall be provided with door positioners and stops. Equipment mounted on a hinged door shall be constructed or shielded in such a manner that no live parts of the door mounted equipment will be exposed to accidental contact by a person with the door open and the circuit energized.

111.45–1(k) *Grounding.* Controller cases, except insulating covers of snap switches, shall be grounded.

111.45–1(l) *Construction.* The construction of controlling apparatus and their enclosures shall conform to the requirements of Underwriters' Laboratories, Inc., Standard for Industrial Control Equipment, except that sheet metal enclosures for installation in corrosive locations shall not be installed unless one of the conditions covered in this paragraph is complied with.

111.45–1(l)(1) The enclosure is fabricated of corrosion-resistant material.

111.45–1(l)(2) The enclosure is fabricated of sheet steel not less than ⅛ inch in thickness and hot dip galvanized after fabrication.

111.45–1(l)(3) The enclosure is fabricated of sheet steel not less than 3/16 inch in thickness and given a corrosion resistant finish in accordance with Section 110.15–40 of this subchapter.

111.45–1(m) *Wearing parts.* All wearing parts of controllers should be readily accessible for inspection and renewal.

111.45–1(n) *Protection against low voltage.* Motor controllers for motors of 2 horsepower or larger shall be provided with protection against low voltage. Low-voltage release should be provided only on controllers for auxiliaries which are vital to the operation of the propelling equipment where automatic restart after a voltage failure will not be hazardous. Otherwise, low-voltage protection should be used. To permit prompt restoration of service after interruption, the starting current and short time sustained current of all low-voltage release loads shall be within the capacity of one generator.

111.45–1(o) *Manually operated controllers.* Manually operated controllers shall be arranged for operation without opening the enclosing case. In the panel type the starting arm shall be arranged so that the motor will stop if the arm be left on a starting point. In regulating drum controllers the resistor shall be proportioned for the duty cycle.

111.45–1(p) *Alternating-current manual auto-starters.* Alternating-current manual auto-starters with self-contained auto-transformers should be provided with switches of the quick-make-and-break type and the starter should be arranged so that it will be impossible to throw to the running position without having first thrown to the starting position. Switches should be preferably of the contactor or air-break type. In case oil is necessary, the starter should not leak when tilted to an angle of 15 degrees and should be constructed to prevent the liquid from splashing out due to the rolling of the vessel.

111.45–1(q) *Identification of controllers.* A controller shall be marked with the maker's name or identification symbol, the voltage, the current or horsepower rating, and such other data as may be needed properly to indicate the motor which it controls. The identification data necessary to indicate the motor which the controller controls shall be on the external surface of the enclosure. A wiring diagram of the controller shall be permanently attached to the inside of the controller door.

111.45–5 Motor overcurrent protection

111.45–5(a) *General.* The following provisions in this section specify overcurrent devices intended to protect the motors, the motor control apparatus, and the branch-circuit conductors against excessive heating due to motor overloads.

111.45–5(b) *Continuous duty motors more than one horsepower.* Each continuous duty motor rated more than one horsepower shall be protected against overcurrent by one of the means covered in this paragraph. For multispeed motors each separate winding or winding connection shall be considered separately.

111.45–5(b)(1) A separate overcurrent device which is responsive to motor current. This device shall be rated or set at not more than 115 percent of the motor full load current rating. For multispeed motors this device shall be rated or set at not more than 115 percent of the full load current rating of each separate winding or winding connection. This value may be modified as permitted by paragraph (g) of this section.

111.45–5(b)(2) A thermal protector integral with the motor, approved for use with the motor which it protects on the basis that it will prevent dangerous overheating of the motor due to overload or failure to start. If the motor current interrupting device is separate from the motor and its control circuit is operated by a protective device integral with the motor, it shall be so arranged that the opening of the control circuit will result in interruption of current to the motor.

111.45–5(b)(3) For sealed (hermetic-type) refrigeration motors the protective device specified in subparagraph (1) or (2) of this paragraph shall be rated or set to trip at not more than 125 percent of the motor full-load line current.

111.45–5(c) *Continuous duty motors, one horsepower or less, manually started.* Any motor of one horsepower or less which is portable, is manually started, and is within sight from the starter location, shall be considered as protected against overcurrent by the overcurrent device protecting the conductors of the branch circuit. This branch circuit overcurrent device shall not be larger than that specified by Table 111.45–20(b3), except that any such motor may be used at 125 volts or less on a branch circuit protected at 20 amperes. Any such motor which is out of sight from the starter location and any such motor which is not portable, shall be protected as specified in paragraph (d) of this section for automatically started motors.

111.45–5(d) *Continuous duty motors, one horsepower or less, automatically started.* Each continuous duty motor rated at one horsepower or less which is automatically started shall be protected against overcurrent by the use of one of the means covered in this paragraph.

111.45–5(d)(1) In the same manner as provided for motors rated at more than one horsepower by Paragraph (b)(1) or Paragraph (b)(2) of this section.

111.45–5(d)(2) If part of an approved assembly which does not normally subject the motor to overloads and which is also equipped with other safety controls which protect the motor against damage due to stalled rotor current, the motor will be considered to be protected. Where such protective equipment is used, it shall be indicated on the nameplate of the assembly where it will be visible after installation.

111.45–5(d)(3) If the impedance of the motor windings is sufficient to prevent overheating due to failure to start, the motor may be protected as specified in Paragraph (c) of this section for manually started motors.

111.45–5(e) *Wound-rotor secondaries.* The secondary circuits of wound-rotor alternating-current motors, including conductors, controllers, resistors, etc., shall be considered as protected against overcurrent by the motor-running overcurrent device.

111.45–5(f) *Intermittent and similar duty.* A motor used for a condition of service which is inherently short time is considered as protected against overcurrent by the branch circuit overcurrent device, provided the overcurrent protection does not exceed that specified in Tables 111.45–20(b1) and 111.45–20(b2). Any motor is considered to be for continuous duty unless the nature of the apparatus which it drives is such that the motor cannot operate continuously with load under any condition or unless permitted by Section 111.25–15.

111.45–5(g) *Selection or setting of protective devices.* Where the values specified for motor-running overcurrent protection do not correspond to the standard sizes or rating of fuses, nonadjustable circuit breakers, thermal cutouts, thermal relays, the heating elements of thermal trip motor switches, or possible settings of adjustable circuit breakers adequate to carry the load, the next higher size, rating, or setting may be used, but not higher than 130 percent of the full-load current rating of the motor except that for sealed (hermetic-type) refrigeration motors the rating or setting of the protective device shall not be higher than 140 percent of the full-load current rating of the motor. If not shunted during the starting period of the motor (see paragraph (h) of this section), the protective device shall have sufficient time delay to permit the motor to start and accelerate its load.

111.45–5(h) *Shunting during starting period.* If the motor is manually started (including starting with a magnetic starter having pushbutton control) the running overcurrent protection may be shunted or cut out of the circuit during the starting period of the motor, provided the device by which the overcurrent protection is shunted or cut out cannot be left in the starting position, and the motor shall be considered as protected against overcurrent during the starting period if fuses or time-delay circuit breakers, rated or set at not over 400 percent of the full-load current of the motor, are so located in the circuit as to be operative during the starting period of the motor. The motor-running overcurrent protection shall not be shunted or cut out during the starting period if the motor is automatically started.

111.45–5(i) *Fuses; in which conductor.* If fuses are used for motor-running protection, a fuse shall be inserted in each ungrounded conductor, except that a fuse shall also be inserted in a grounded conductor under the circumstances set forth in footnote 1 of Table 111.45–5(j) for circuits supplied by wye-delta or delta-wye connected transformers.

111.45–5(j) *Devices other than fuses; in which conductors.* If devices other than fuses are used for motor-running protection, Table 111.45–5(j) shall govern the minimum allowable number and location of overcurrent units, such as trip coils, relays, or thermal cutouts.

111.45–5(k) *Number of conductors disconnected by overcurrent devices.* Motor-running protective devices, other than fuses, thermal cutouts, or thermal protectors, shall simultaneously open a sufficient number of ungrounded conductors to interrupt current flow to the motor.

111.45–5(l) *Motor controller as running protection.* A motor controller may also serve as the running overcurrent device if the number of overcurrent units complies with Table 111.45–5(j), and if these overcurrent units are operative in both the starting and running position in the case of a direct-current motor, and in the running position in the case of an alternating-current motor.

111.45–5(m) *Thermal cutouts and relays.* Thermal cutouts, thermal relays and other devices for motor-running protection which are not capable of opening short circuits, shall be protected by fuses or circuit breakers with rat-

TABLE 111.45–5(j)—*Minimum number and location of motor-running protective devices.*

Kind of motor	Supply system	Number and location of overcurrent units, such as trip coils, relays, or thermal cut-outs
1-phase alternating-current or direct-current.	2-wire, 1-phase alternating-current or direct-current, ungrounded.	1 in either conductor.
1-phase alternating-current or direct-current.	2-wire, 1-phase alternating-current or direct-current, one conductor grounded.	1 in ungrounded conductor.
1-phase alternating-current or direct-current.	3-wire, 1-phase alternating-current or direct-current, grounded neutral.	1 in either ungrounded conductor.
3-phase alternating-current.	3-wire, 3-phase alternating-current, ungrounded.	2 in any 2 conductors.[1]
3-phase alternating-current.	3-wire, 3-phase, one conductor grounded.	2 in ungrounded conductors.[1]
3-phase alternating-current.	3-wire, 3-phase alternating-current, grounded neutral.	2 in any 2 conductors.[1]
3-phase alternating-current.	4-wire, 3-phase alternating-current, grounded neutral or ungrounded.	2 in any 2 conductors, except the neutral.[1]

[1] In the case of distribution systems supplying wye-delta or delta-wye connected transformers (having the wye neutral point in the primary ungrounded or not connected to the circuit) three running overcurrent units shall be provided for the protection of 3-phase 3-wire motors.

ings or settings of not over 4 times the rating of the motor for which they are designed, unless approved for group installation, and marked to indicate the maximum rating or setting of the overcurrent device by which they must be protected.

111.45–5(n) *Rating of protective devices.* Motor-running overcurrent devices other than fuses shall have a rating of at least 115 percent of the full-load current rating of the motor.

111.45–5(o) *Automatic restarting.* A motor-running protective device which can restart a motor automatically after overcurrent tripping shall not be installed.

111.45–5(p) *Steering gear motors.* Main steering gear motors and motors associated with steering control systems shall not be provided with a motor-running protective device. In lieu of a motor-running overcurrent protection, the motor starter shall be fitted with a protective device responsive to motor current, motor temperature, or to both current and temperature which will operate an indicating light at the propulsion control station in case of overload which would cause overheating of the motor. This device shall follow as closely as practicable the temperature of the motor.

111.45–10 Remote-control, electrical interlock, and indicator circuits

111.45–10(a) *General.* The deviations from the general requirements in this subchapter as covered by this section are intended to provide for peculiar conditions governing remote-control, electrical interlock, and indicator circuits.

11.45–10(b) *Overcurrent protection.* Conductors of control, electrical interlock, and indicator circuits of motor controllers shall be considered as being properly protected against overcurrent by the branch circuit overcurrent device where the conductors are wholly within the controller enclosure. Conductors of control, electrical interlock, and indicator circuits external to the controller enclosure shall be considered as being properly protected against overcurrent under any one of the conditions listed in this paragraph.

111.45–10(b)(1) If the rating or setting of the branch-circuit overcurrent device is not more than 500 percent of the current-carrying capacity of the control, electrical interlock, or indicator circuit conductors.

111.45–10(b)(2) By overcurrent devices, in both sides of the line, having a rating or setting of not more than 500 percent of the current-carrying capacity of the control, electrical interlock, or indicator circuit conductors, except that where under operating conditions there is no appreciable difference in potential between the external conductors, overcurrent protection need only be provided at the supply of that side of the line.

111.45–10(b)(3) If the opening of the control, electrical interlock, or indicator circuit would create a hazard, no overcurrent protection shall be provided.

111–45.10(b)(4) For overcurrent protection of steering gear control and indicator light circuits see Subparagraph 111.65–55(d)(2).

111.45–10(c) *Accidental grounds.* It is recommended that remote control circuits be so arranged that an accidental ground will not start the motor.

111.45–10(d) *Source of potential.* The potential for a control, interlock, or indicator circuit shall be derived from the load side of the motor and controller disconnect means specified by Section 111.45–30, except that where the control functions are such that such circuits must be common to two or more controllers, the switching arrangements specified by paragraph (e) of this section, shall be complied with.

111.45–10(e) *Switching.* In the design of control, interlock, and indicator circuits, all possible steps shall be taken to eliminate more than one source of potential in an enclosure. Where the control functions are such as to make it impracticable to energize a control, interlock, or indicator circuit from the load side of the motor and controller disconnect means specified by Section 111.45–30, one of the following alternative methods of switching shall be employed:

111.45–10(e)(1) The potential of the control, interlock, or indicator circuits shall be limited to not more than 24 volts, in which case no disconnecting means need be provided.

111.45–10(e)(2) The conductors of control, interlock, or indicator circuits shall be disconnected from all sources of potential by a disconnect device independent of the motor and controller disconnect device specified by Section 111.45–30. The two independent devices shall be located immediately adjacent one to the other, and a sign, warning the operator to open both devices to disconnect completely the motor and controller, shall be permanently attached to the exterior of the door of the main disconnect device.

111.45–10(e)(3) The conductors of control, interlock, or indicator circuits shall be disconnected from all sources of potential by a disconnect device actuated by the opening of the controller door, this device and its connections (including terminal blocks, when employed, for terminating the ship's wiring) being such that there are no electrically uninsulated or unshielded surfaces.

111.45–15 Heater circuits

111.45–15(a) Where motors, master switches and similar enclosures, except motor controllers, are fitted with electric heaters located inside the enclosures and energized from a separate circuit, the heater circuits shall be disconnected in the same manner as required for control, interlock and indicator circuits in Subparagraph 111.45–10(e)(2). In the case of deck machinery, when the location of the motor, master switch, or similar enclosure is remote from the motor and controller disconnect device, a warning sign may be affixed to the unit enclosure warning the operator of the presence of two sources of potential within the unit enclosure and giving the location of the heater circuit disconnect device in lieu of the disconnect arrangement required by Subparagraph 111.45–10(e)(2). Electric heaters installed within motor controllers and energized from a separate circuit shall be disconnected in the same manner as required by Paragraph 111.45–10(e).

111.45–20 Motor-branch-circuit overcurrent protection

111.45–20(a) *General.* The provisions covered by this section specify overcurrent devices intended to protect the motor-branch-circuit conductors, the motor control apparatus, and the motors against overcurrent due to short circuits or grounds. They are in addition to or amendatory of the provisions of Subpart 111.55.

111.45–20(b) *Rating or setting for individual motors.* The motor-branch-circuit overcurrent device shall be capable of carrying the starting current of the motor. Overcurrent protection shall be considered as being obtained when this overcurrent device has a rating or setting not exceeding the values given in Tables 111.45–20(b1) and 111.45–20(b2).

111.45–20(b)(1) If the values for motor-branch-circuit protective devices given in Tables 111.45–20(b1) and 111.45–20(b2) do not correspond to the standard sizes of fuses or ratings of nonadjustable circuit breakers or possible settings of adjustable circuit breakers adequate to carry the load, the next higher size, rating or setting may be used.

TABLE 111.45–20(b1)—*Maximum rating or setting of motor branch circuit protective devices for motors marked with a code letter indicating locked rotor KVA.*

Type of motor [2]	Percent of full-load current [1]	
	Fuse rating (see also Table 111.45–20 (b3))	Circuit breaker setting; time-limit type
All a.c. single-phase and polyphase squirrel cage and synchronous motors with full-voltage, resistor or reactor starting:		
Code Letter A	150	150
Code Letter B to E	250	200
Code Letter F to V	300	250
All a.c. squirrel cage and synchronous motors with autotransformer starting:		
Code Letter A	150	150
Code Letter B to E	200	200
Code Letter F to V	250	200

[1] For certain exceptions to the values specified, see paragraphs 111.45–5(c), 111.45–20(b), and 111.45–20(g).

[2] For motors not marked with a code letter, see Table 111.45–20(b2).

111.45–20(b)(2) Where the overcurrent protection specified in Tables 111.45–20(b1) and 111.45–20(b2) is not sufficient for the starting current of the motor, it may be increased but shall, in no case exceed 400 percent of the motor full-load current.

111.45–20(b)(3). Table 111.45–20(b3) tabulates usual values of motor-branch-circuit protection, motor-running protection, and minimum cable size for various motor full-load currents for ease of reference.

111.45–20(c) *Several motors on one branch circuit.* Two or more motors may be connected to the same branch circuit under the conditions covered in this paragraph.

111.45–20(c)(1) Two or more motors each not exceeding 1 horsepower in rating and each having a full-load rated current not ex-

TABLE 111.45–20(b2)—*Maximum rating or setting of motor branch circuit protective devices for motors not marked with a code letter indicating locked rotor KVA.*

Type of motor [3]	Percent of full-load current [1] [2]		
	Fuse rating	Circuit breaker setting	
		Instantaneous type	Time limit type
Single-phase, all types	300	--------	250
Squirrel cage and synchronous (full-voltage, resistor and reactor starting)	300	--------	250
Squirrel cage and synchronous (auto-transformer starting):			
Not more than 30 amperes	250	--------	200
More than 30 amperes	200	--------	200
High-reactance squirrel cage:			
Not more than 30 amperes	250	--------	250
More than 30 amperes	200	--------	200
Wound rotor	150	--------	150
Direct current:			
Not more than 50 horsepower	150	250	150
More than 50 horsepower	150	175	150

[1] For certain exceptions to the values specified see paragraphs 111.45–5(c), 111.45–20(b), and 111.45–20(g).

[2] Synchronous motors of the low-torque low-speed type (usually 450 r.p.m. or lower) such as are used to drive reciprocating compressors, pumps, etc., which start up unloaded, do not require a fuse rating or circuit breaker setting in excess of 200 percent of full-load current.

[3] For motors marked with a code letter, see table 111.45–20 (b1).

ceeding 6 amperes, may be used on a branch circuit protected at not more than 20 amperes at 125 volts or less, or 15 amperes at 600 volts or less. Individual running overcurrent protection is unnecessary for such motors unless required by the provisions of Paragraph 111.45–5 (c) or (d).

111.45–20(c)(2) Two or more motors of any ratings, each having individual running overcurrent protection, may be connected to one branch circuit provided all of the conditions contained in this subparagraph are complied with.

111.45–20(c)(2)(i) Each motor-running overcurrent device must be approved for group installation.

111.45–20(c)(2)(ii) Each motor controller must be approved for group installation.

111.45–20(c)(2)(iii) The branch circuit must be protected by an overcurrent device having a rating or setting equal to that specified in Paragraph (b) of this section for the largest motor connected to the branch circuit plus an amount equal to the sum of the full-load current ratings of all other motors connected to the circuit.

111.45–20(c)(2)(iv) The branch circuit overcurrent protection must not be greater than that allowed by Paragraph 111.45–5(m) for the thermal cutout or relay protecting the smallest motor of the group.

111.45–20(c)(2)(v) The conductors of any tap supplying a single motor need not have individual branch circuit protection, provided they comply with either of the following: (a) No conductor to the motor shall have a current-carrying capacity less than that of the branch circuit conductors; or (b) no conductor to the motor shall have a current-carrying capacity less than one third that of the branch circuit conductors, with a minimum in accordance with Paragraph (b) of this Section, the conductors to the motor-running protective device being not more than 25 feet long and being protected from mechanical injury.

111.45–20(d) *Combined overcurrent protection.* Motor-branch-circuit overcurrent protection and motor-running overcurrent protection may be combined in a single overcurrent device if the rating or setting of the device provides the running overcurrent protection specified in Paragraphs 111.45–5 (b), (c), and (d).

111.45–20(e) *Overcurrent devices; in which conductor.* Overcurrent devices shall comply with the provisions of Subpart 111.55.

111.45–20(f) *Rating of circuit breakers.* Circuit breakers for motor-branch-circuit protection shall have a continuous current rating of not less than 115 percent of the full-load current rating of the motors.

111.45–20(g) *Selection or setting of protective devices.* If the values for branch circuit protective devices required by this section do not correspond to the standard sizes or ratings of fuses, nonadjustable circuit breakers, or thermal devices, or possible settings of adjustable circuit breakers, adequate to carry the load, the next higher size, rating, or setting may be used.

111.45–20(h) *Steering gear motor branch circuits.*

111.45–20(h)(1) *General.* In lieu of the requirements of paragraphs (a) to (f), inclusive, of this section, each steering gear branch circuit shall be protected only by a circuit breaker with instantaneous trip located on the switchboard from which it emanates.

111.45–20(h)(2) *Direct-current motors.* For direct-current steering gear motors, each circuit breaker shall be of the instantaneous trip type only, set to trip at a current of not less than 300 percent and not greater than 375 percent of the rated full-load current of one steering gear main motor.

111.45–20(h)(3) *Alternating-current motors.* For alternating-current steering gear motors, each circuit breaker shall be of the instantaneous trip type only, set to trip at a current of approximately 175 percent of the locked rotor current of one steering gear main motor.

★Table 111.45–20(b3)—*Conductor Size and overcurrent Protection for Motors*

Full load current rating of motor in amperes	Minimum size conductor AWG and MCM									For running protection of motors (amperes)[1]		Maximum allowable rating or setting of branch circuit protective devices (amperes)[2]							
	1-conductor			2-conductor			3-conductor			Maximum rating of nonadjustable protective devices	Maximum setting of adjustable protective devices	With code letters F to V, inclusive, or without code letters: Single-phase and squirrel cage and synchronous, full voltage, resistor and reactor starting		With code letters B to E, inclusive: Single-phase and squirrel cage and synchronous, full voltage resistor or reactor starting. With code letters F to V, inclusive: Auto-transformer starting. Without code letters: Squirrel cage and synchronous, auto-transformer starting; high reactance squirrel cage.[3] (Both not more than 30 amperes)		With code letters B to E, inclusive: Squirrel cage and synchronous, auto-transformer, starting. Without code letters: Squirrel cage and synchronous, auto-transformer starting; high reactance squirrel cage.[3] (Both more than 30 amperes)		With code letter A: All motors, Without code letters: Direct-current and wound rotor motors	
	R	VC	AVC	R	VC	AVC	R	VC	AVC			Fuses	Circuit breakers (nonadjustable trip)	Fuses	Circuit breakers (nonadjustable trip)	Fuses	Circuit breakers (nonadjustable trip)	Fuses	Circuit breakers (nonadjustable trip)
[4] 1	14	12	14	14	12	14	14	12	14	[5] 2	[5] 1.15	15	15	15	15	15	15	15	15
[4] 2	14	12	14	14	12	14	14	12	14	[5] 3	[5] 2.3	15	15	15	15	15	15	15	15
[4] 3	14	12	14	14	12	14	14	12	14	[5] 4	[5] 3.45	15	15	15	15	15	15	15	15
[4] 4	14	12	14	14	12	14	14	12	14	[5] 6	[5] 4.6	15	15	15	15	15	15	15	15
[4] 5	14	12	14	14	12	14	14	12	14	[5] 6	[5] 5.75	15	15	15	15	15	15	15	15
6	14	12	14	14	12	14	14	12	14	[5] 8	[5] 6.9	20	15	15	15	15	15	15	15
7	14	12	14	14	12	14	14	12	14	[5] 10	[5] 8.05	25	20	20	15	15	15	15	15
8	14	12	14	14	12	14	14	12	14	[5] 10	[5] 9.2	25	20	20	20	20	20	15	15
9	14	12	14	14	12	14	14	12	14	[5] 12	[5] 10.35	30	30	25	20	20	20	15	15
10	14	12	14	14	12	14	14	12	14	[5] 12	[5] 11.5	30	30	25	20	20	20	15	15
11	14	12	14	14	12	14	14	12	14	[5] 15	[5] 12.65	35	30	30	30	25	30	20	20
12	14	12	14	14	12	14	14	12	14	15	13.8	40	30	30	30	25	30	20	20
13	12	12	14	12	12	14	12	12	14	15	14.95	40	40	35	30	30	30	20	20
14	12	12	14	12	12	14	12	12	12	20	16.1	45	40	35	30	30	30	25	30
15	12	12	14	12	12	14	12	12	12	20	17.25	45	40	40	30	30	30	25	30
16	12	12	14	12	12	12	12	12	12	20	18.4	50	40	40	40	35	40	25	30
17	12	12	12	12	12	12	10	12	12	20	19.55	60	50	45	40	35	40	30	30
18	12	12	12	10	12	12	10	12	12	25	20.7	60	50	45	40	40	40	30	30
19	12	12	12	10	12	12	10	10	12	25	21.8	60	50	50	40	40	40	30	30
20	10	12	12	10	12	12	10	10	12	25	23.0	60	50	50	40	40	40	30	30
22	10	12	12	10	10	12	10	10	10	30	25.3	70	70	60	50	45	50	35	40
24	10	12	12	10	10	12	8	10	10	30	27.6	80	70	60	50	50	50	40	40
26	10	10	12	8	10	10	8	10	10	30	29.9	80	70	70	70	60	70	40	40
28	8	10	12	8	10	10	8	8	10	35	32.2	90	70	70	70	60	70	45	50
30	8	10	10	8	10	10	8	8	10	35	34.5	90	100	80	70	60	70	45	50
32	8	10	10	8	10	10	7	8	8	40	36.8	100	100	80	70	70	70	50	50
34	8	10	10	7	8	10	7	8	8	40	39.1	110	100	90	70	70	70	60	70
36	8	10	10	7	8	10	6	8	8	45	41.4	110	100	90	100	80	100	60	70
38	7	10	10	7	8	8	6	7	8	45	43.7	125	100	100	100	80	100	60	70
40	7	8	10	6	8	8	5	7	8	50	46.0	125	100	100	100	80	100	60	70
42	7	8	10	6	8	8	5	6	7	50	48.3	125	125	110	100	90	100	70	70
44	6	8	8	6	8	8	5	6	7	60	50.6	125	125	110	100	90	100	70	70
46	6	8	8	5	7	8	4	6	6	60	52.9	150	125	125	100	100	100	70	70
48	6	8	8	5	7	8	4	6	6	60	55.2	150	125	125	100	100	100	80	100
50	6	8	8	5	7	7	4	5	6	60	57.5	150	125	125	100	100	100	80	100
52	5	8	8	4	6	7	4	5	6	60	59.8	175	150	150	125	110	125	80	100
54	5	7	8	4	6	7	3	5	5	70	62.1	175	150	150	125	110	125	90	100
56	5	7	8	4	6	7	3	5	5	70	64.4	175	150	150	125	125	125	90	100
58	4	7	8	4	6	6	3	4	5	70	66.7	175	150	150	125	125	125	90	100
60	4	6	7	3	5	6	3	4	5	70	69.0	200	150	150	125	125	125	90	100
62	4	6	7	3	5	6	2	4	5	80	71.3	200	175	175	125	125	125	100	100
64	4	6	7	3	5	6	2	4	4	80	73.6	200	175	175	150	150	150	100	100
66	4	6	6	3	5	5	2	3	4	80	75.9	200	175	175	150	150	150	100	100
68	4	6	6	3	5	5	2	3	4	80	78.2	225	175	175	150	150	150	110	125
70	3	5	6	2	4	5	1	3	4	90	80.5	225	175	175	150	150	150	110	125
72	3	5	6	2	4	5	1	3	3	90	82.8	225	200	200	150	150	150	110	125
74	3	5	6	2	4	5	1	2	3	90	85.1	225	200	200	150	150	150	125	125
76	3	5	6	2	4	5	1	2	3	90	87.4	250	200	200	175	175	175	125	125
78	3	5	5	1	3	4	1	2	3	90	89.7	250	200	200	175	175	175	125	125
80	2	4	5	1	3	4	0	2	3	100	92.0	250	200	200	175	175	175	125	125

See footnotes at end of table.

★Table 111.45–20(b3)—*Conductor Size and overcurrent Protection for Motors*—Continued

Full load current rating of motor in amperes	Minimum size conductor AWG and MCM									For running protection of motors (amperes)[1]		Maximum allowable rating or setting of branch circuit protective devices (amperes)[2]							
	1-conductor			2-conductor			3-conductor			Maximum rating of nonadjustable protective devices	Maximum setting of adjustable protective devices	With code letters F to V, inclusive, or without code letters: Single-phase and squirrel cage and synchronous, full voltage, resistor and reactor starting		With code letters B to E, inclusive: Single-phase and squirrel cage and synchronous, full voltage resistor or reactor starting. With code letters F to V, inclusive: Auto-transformer starting. Without code letters: Squirrel cage and synchronous, auto-transformer starting; high reactance squirrel cage.[3] (Both not more than 30 amperes)		With code letters B to E, inclusive: Squirrel cage and synchronous, auto-transformer, starting. Without code letters: Squirrel cage and synchronous, auto-transformer starting; high reactance squirrel cage.[3] (Both more than 30 amperes)		With code letter A: All motors, Without code letters: Direct-current and wound rotor motors	
	R	VC	AVC	R	VC	AVC	R	VC	AVC			Fuses	Circuit breakers (nonadjustable trip)	Fuses	Circuit breakers (nonadjustable trip)	Fuses	Circuit breakers (nonadjustable trip)	Fuses	Circuit breakers (nonadjustable trip)
82	2	4	5	1	3	4	0	2	2	100	94.3	250	225	225	175	175	175	125	125
84	2	4	5	1	3	4	0	2	2	100	96.6	250	225	225	175	175	175	150	150
86	2	4	5	1	3	4	0	1	2	100	98.9	300	225	225	175	175	175	150	150
88	2	4	5	1	3	3	0	1	2	110	101.2	300	225	225	200	200	200	150	150
90	2	4	4	0	2	3	0	1	2	110	103.5	300	225	225	200	200	200	150	150
92	2	3	4	0	2	3	00	1	2	110	105.8	300	250	250	200	200	200	150	150
94	1	3	4	0	2	3	00	1	2	110	108.1	300	250	250	200	200	200	150	150
96	1	3	4	0	2	3	00	1	1	125	110.4	300	250	250	200	200	200	150	150
98	1	3	4	0	2	3	00	1	1	125	112.7	300	250	250	200	200	200	150	150
100	1	3	4	0	2	2	00	0	1	125	115	300	250	250	200	200	200	150	150
105	1	3	3	00	1	2	000	0	1	125	120.75	350	300	300	225	225	225	175	175
110	0	2	3	00	1	2	000	0	0	150	126.5	350	300	300	225	225	225	175	175
115	0	2	3	00	1	1	000	00	0	150	132.25	350	300	300	250	250	250	175	175
120	0	2	2	000	0	1	4/0	00	0	150	138	400	300	300	250	250	250	200	200
125	00	1	2	000	0	1	4/0	00	0	150	143.75	400	350	350	250	250	250	200	200
130	00	1	2	000	0	1	4/0	00	00	150	149.5	400	350	350	300	300	300	200	200
135	00	1	2	4/0	0	0	4/0	000	00	175	155.25	450	350	350	300	300	300	225	225
140	00	1	1	4/0	00	0	250	000	00	175	161	450	350	350	300	300	300	225	225
145	000	0	1	4/0	00	0	250	000	00	175	166.75	450	400	400	300	300	300	225	225
150	000	0	1	4/0	00	0	300	000	000	175	172.5	450	400	400	300	300	300	225	225
155	000	0	1	4/0	00	00	300	4/0	000	200	178.25	500	400	400	350	350	350	250	250
160	000	0	0	250	000	00	300	4/0	000	200	184	500	400	400	350	350	350	250	250
165	000	0	0	250	000	00	300	4/0	000	200	189.75	500	500	450	350	350	350	250	250
170	4/0	00	0	250	000	00	350	4/0	4/0	200	195.5	500	500	450	350	350	350	300	300
175	4/0	00	0	300	000	000	350	250	4/0	225	201.25	600	500	450	350	350	350	300	300
180	4/0	00	0	300	4/0	000	350	250	4/0	225	207	600	500	450	400	400	400	300	300
185	4/0	00	00	300	4/0	000	350	250	4/0	225	212.75	600	500	500	400	400	400	300	300
190	4/0	00	00	300	4/0	000	400	250	4/0	225	218.5	600	500	500	400	400	400	300	300
195	250	000	00	350	4/0	000	400	300	250	225	224.25	600	500	500	400	400	400	300	300
200	250	000	00	350	4/0	4/0	450	300	250	250	230	600	500	500	400	400	400	300	300
210	250	000	00	350	250	4/0	450	300	250	250	241.5	-------	600	600	500	450	500	350	350
220	300	4/0	000	400	250	4/0	500	350	300	300	253	-------	600	600	500	450	500	350	350
230	300	4/0	000	450	300	250	550	350	300	300	264.5	-------	600	600	500	500	500	350	350
240	300	4/0	000	450	300	250	550	400	350	300	276	-------	600	600	500	500	500	400	400
250	350	250	4/0	500	300	250	600	400	350	300	287.5	-------	--------	-------	500	500	500	400	400
260	350	250	4/0	500	350	300	650	450	350	300	299	-------	--------	-------	600	600	600	400	400
270	350	250	4/0	550	350	300	650	450	400	350	310.5	-------	--------	-------	600	600	600	450	500
280	400	250	250	600	350	300	-----	500	400	350	322	-------	--------	-------	600	600	600	450	500
290	400	300	250	600	400	350	-----	500	450	350	333.5	-------	--------	-------	600	600	600	450	500
300	450	300	250	650	400	350	-----	550	450	350	345	-------	--------	-------	600	600	600	450	500
320	500	350	300	-----	450	400	-----	600	500	400	368	-------	--------	-------	--------	-------	--------	500	500
340	550	350	300	-----	500	450	-----	650	550	400	391	-------	--------	-------	--------	-------	--------	600	600
360	600	400	350	-----	550	450	-----	-----	600	450	414	-------	--------	-------	--------	-------	--------	600	600
380	650	450	350	-----	600	500	-----	-----	650	450	437	-------	--------	-------	--------	-------	--------	600	600
400	700	450	400	-----	650	550	-----	-----	------	500	460	-------	--------	-------	--------	-------	--------	600	600
420	750	500	450	-----	-----	600	-----	-----	------	500	483	-------	--------	-------	--------	-------	--------	-------	--------
440	800	550	450	-----	-----	650	-----	-----	------	600	506	-------	--------	-------	--------	-------	--------	-------	--------
460	850	600	500	-----	-----	------	-----	-----	------	600	529	-------	--------	-------	--------	-------	--------	-------	--------
480	950	650	550	-----	-----	------	-----	-----	------	600	552	-------	--------	-------	--------	-------	--------	-------	--------
500	1,000	650	550	-----	-----	------	-----	-----	------	600	575	-------	--------	-------	--------	-------	--------	-------	--------

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[1] Values may be modified as permitted by Section 111.45–5.

[2] Values may be modified as permitted by Section 111.45–20.

[3] High-reactance squirrel cage motors are those designed to limit the starting current by means of deep-slot secondaries or double-wound secondaries and are generally started on full voltage.

[4] For the grouping of small motors under the protection of a single set of fuses, see paragraph 111.45–20(c).

[5] For running protection of motors of 1 horsepower or less, see paragraph 111.45–5(c).

111.45–20(h)(4) *Use of fuses.* On vessels of a size that may be steered by hand, fused switches may be substituted for the instantaneous trip circuit breakers required by this paragraph: *Provided*, That the arrangement of the steering gear is such that it is possible to shift to hand steering without delay: *And provided further*, That the opening of a steering gear branch circuit fuse is indicated in the wheelhouse.

111.45–20(h)(5) *General considerations.* The requirements of this paragraph contemplate the following conditions:

111.45–20(h)(5)(i) When two steering gear main motors are provided, one is a standby which normally runs only when started preparatory to changeover, and then without load.

111.45–20(h)(5)(ii) Auxiliary motors (servo, replenishing and filling pumps, etc.), if and as required, have an aggregate rating of not more than 10 percent of the main steering gear motor rating.

111.45–25 Motor feeder overcurrent protection

111.45–25(a) *General.* The following provisions contained in this section specify overcurrent devices intended to protect feeder conductors supplying motors against overcurrents due to short-circuits or grounds.

111.45–25(b) *Rating or setting, motor loads.*

111.45–25(b)(1) A feeder which supplies motors shall be provided with overcurrent protection which shall not be greater than the largest rating or setting of the branch circuit protective device, for any motor of the group (based on Tables 111.45–20(b1), 111.45–20(b2), and 111.45–20(b3)) plus the sum of the full load currents of the other motors of the group.

111.45–25(b)(2) If 2 or more motors of equal horsepower rating are the largest in the group, one of these motors should be considered as the largest for the above calculation.

111.45–25(b)(3) If 2 or more motors of a group must be started simultaneously, it may be necessary to install larger feeder conductors and correspondingly larger ratings or settings of feeder overcurrent protective devices.

111.45–25(b)(4) Where larger capacity feeders are installed to provide for future additions or changes, the feeder overcurrent protection may be based on the rated current-carrying capacity of the feeder conductors.

111.45–30 Disconnecting means

111.45–30(a) *General.* The provisions contained in this section are intended to require disconnecting means for motors and controllers capable of disconnecting them from the circuit.

111.45–30(b) *Type.* The disconnecting means shall be an enclosed, externally operable, motor-circuit switch, rated in horsepower, or a circuit breaker, except as permitted in the paragraphs (c), (d), (e), (f), and (g) of this section. Every switch in the motor branch circuit within sight from the controller location shall comply with these requirements.

111.45–30(c) *One-eighth horsepower or less.* For stationary motors of ⅛ horsepower or less, the branch circuit overcurrent device may serve as the disconnecting means.

111.45–30(d) *Two horsepower or less.* For stationary motors rated at 2 horsepower or less and 300 volts or less, the disconnecting means may be a general-use switch having an ampere rating at least twice the full-load current rating of the motor.

111.45–30(e) *Over two horsepower to and including 50 horsepower.* The separate disconnecting means required for a motor with an autotransformer type of controller may be a general-use switch if all of the provisions contained in this paragraph are complied with.

111.45–30(e)(1) The motor drives a generator which is provided with overcurrent protection.

111.45–30(e)(2) The controller is:

111.45–30(e)(2)(i) Capable of interrupting the stalled rotor current of the motor.

111.45–30(e)(2)(ii) Provided with a low-voltage release.

111.45–30(e)(2)(iii) Provided with running overcurrent protection not exceeding 115 percent of the motor full-load current rating.

111.45–30(e)(3) Separate fuses or a circuit breaker, rated or set at not more than 150 percent of the motor full-load current are provided in the motor branch circuit.

111.45–30(f) *Exceeding 50 horsepower.* For stationary motors rated at more than 50 horsepower, the disconnecting means may be a motor-circuit switch also rated in amperes, a general-use switch, or an isolating switch. Isolating and general-use switches for motors exceeding 50 horsepower, not capable of interrupting stalled-rotor currents, shall be plainly marked "Do not open under load".

111.45–30(g) *Portable motors.* For portable motors an attachment plug and receptacle may serve as the disconnecting means.

111.45–30(h) *Current-carrying capacity.* The disconnecting means shall have a current-carrying capacity of at least 115 percent of the current rating of the motor.

111.45–30(i) *Poles; in which conductors.*

The disconnecting means shall simultaneously open all conductors.

111.45–30(j) *To be indicating.* The disconnecting means shall plainly indicate whether it is in the open or closed position.

111.45–30(k) *To disconnect both motor and controller.* The disconnecting means shall disconnect both the motor and the controller from all supply conductors. The disconnecting means may be in the same enclosure with the controller.

111.45–30(l) *Switch or circuit breaker as both controller and disconnecting means.* A switch or circuit breaker complying with the provisions of Paragraph 111.45–1(b) may serve as both controller and disconnecting means if it opens all conductors to the motor, is protected by an overcurrent device (which may be the branch circuit fuses) which opens all ungrounded conductors to the switch or circuit breaker, and is one of the types listed in this paragraph.

111.45–30(l)(1) An airbreak switch, operable directly by applying the hand to a lever or handle.

111.45–30(l)(2) A circuit breaker switch operable directly by applying the hand to a lever or handle.

111.45–30(l)(3) An oil switch used on a circuit whose rating does not exceed 600 volts or 100 amperes, or on a circuit exceeding this capacity if under expert supervision and by special approval.

111.45–30(l)(4) The oil switch or circuit breaker specified above may be both power and manually operable. If power operable, provisions shall be made to lock it in the open position. The overcurrent device protecting the controller may be part of the controller assembly or may be separate. A compensator type controller is not included above and will require a separate disconnecting means.

111.45–30(m) *Panelboard or switchboard devices, as disconnecting means.* A branch circuit switch or circuit breaker may serve as the disconnecting means provided it conforms to all the requirements of this section. When provision for locking in the open circuit position is required by paragraph (n) of this section, accessibility for manual operation of any other switch or circuit breaker on the panelboard or switchboard shall not be interfered with.

111.45–30(n) *In sight from controller location.* The disconnecting means shall be located within sight of controller location or be arranged to be locked in the open circuit position. A distance of more than 50 feet is considered equivalent to being out of sight. The disconnecting means shall be located in the same ship's compartment with the controller.

111.45–30(o) *Motors served by a single disconnecting means.* Each motor shall be provided with individual disconnecting means, except that for motors of 600 volts or less a single disconnecting means may serve a group of motors under any one of the conditions covered in this paragraph. The disconnecting means serving a group of motors shall have a rating not less than is required by Paragraph (b) of this section for a single motor whose rating equals the sum of the horsepowers or currents of all motors of the group.

111.45–30(o)(1) If a number of motors drive several parts of a single machine or piece of apparatus such as metal and woodworking machines, cranes, and hoists.

111.45–30(o)(2) If a group of motors is under the protection of one set of overcurrent devices as permitted by Paragraph 111.45–20(c).

111.45–30(p) *Readily accessible.* The disconnecting means shall be readily accessible.

111.45–35 Special requirements for over 600 volts

111.45–35(a) *General.* The following provisions contained in this section recognize the additional hazard due to the use of high voltage. They are in addition to or amendatory of the other provisions of this subpart.

111.45–35(b) *Motor overcurrent protection.* Running overcurrent protection for a motor of over 600 volts shall consist of a circuit breaker, or of overcurrent units integral with the controller which shall simultaneously open all ungrounded conductors to the motor. The overcurrent device shall have a setting as specified in Section 111.45–5.

111.45–35(c) *Circuit overcurrent protection.* Each motor branch circuit and feeder of more than 600 volts shall be protected against overcurrent by means of a circuit breaker of suitable rating so arranged that it can be serviced without hazard.

111.45–40 Group control panels

111.45–40(a) *General.* The provisions in this section are in addition to and amendatory of the other provisions of this subpart and are applicable to two or more motor controllers grouped into a motor control center and supplied by a common feeder. The provisions of this paragraph are not applicable to the controllers for two or more motors driving several parts of a single machine or piece of apparatus when the controllers are grouped or installed in a single enclosure.

111.45–40(b) *Arrangement.* Each controller and its associated motor overcurrent protective device, motor branch circuit overcurrent protective device and disconnecting means shall be mounted in a common metal enclosure provided with a hinged door.

111.45–40(c) *Door interlock.* The hinged door required above shall be interlocked with the disconnect device to prevent the door being opened with the circuit energized.

111.45–40(d) *Working space.* Working space, generally not less than 30 inches and at no point less than 24 inches, shall be provided in front of group control boards. Where access to the rear is required for making connections and for subsequent inspections, or for other purposes, space adequate for the work to be done, and in no case less than 18 inches, shall be provided.

111.45–40(e) *Nameplates.* Circuit nameplates in accordance with Paragraph 111.35–1 (h) shall be provided.

111.45–40(f) *Motor and motor branch circuit overcurrent protection.* In lieu of the requirements of Paragraphs 111.45–5(m) and 111.45–20(b), a motor branch circuit of group control panels may be considered to be protected against overcurrent by an instantaneous trip circuit breaker set to trip at a value not exceeding 1500 percent of the motor full-load current, provided that all the conditions of this paragraph are fulfilled.

111.45–40(f)(1) The thermal cutout, thermal relay, or other device for motor-running protection shall be capable of operation without damage to itself from a current up to the setting of the branch circuit circuit breaker.

111.45–40(f)(2) The motor controller shall be capable of opening the circuit without damage to itself resulting from a current up to the setting of the branch circuit circuit breaker.

111.50 DISTRIBUTION AND CIRCUIT LOADS

111.50–1 Distribution, general requirements

111.50–1(a) *General.* The ship's structure shall not be used as a normal current-carrying conductor for a ship's power, heating or lighting system, except when approved for special purposes. Such hull return shall not be used on tankers. Current-carrying parts are to be substantially protected against accidental contact. For current-carrying capacities of conductors, see Tables 111.60–1(e)(1)(i) and 111.60–1(e)(1)(ii).

111.50–1(b) *Circuits derived from auto-transformers.* Branch circuits shall not be supplied through auto-transformers (transformers in which a part of the winding is common to both primary and secondary circuits).

111.50–1(c) *Polarity identification of conductors.*

111.50–1(c)(1) On systems having a grounded conductor, the grounded conductor shall be identified throughout the vessel by means of a white or natural gray conductor outer covering, and any conductor so identified shall not be used as an ungrounded conductor of a circuit unless the conductor is rendered permanently unidentified by painting or other effective means at each outlet. On ungrounded systems, it is recommended that conductor identification be consistent throughout the vessel.

111.50–1(c)(2) An insulated conductor of a portable cable intended to be used as a grounding conductor shall have a continuous identifying marker readily distinguishing it from the other conductors. The identifying marker shall consist of either a braid finished to show a green color or a green colored insulation. The requirements of this subparagraph shall be effective on vessels contracted for on or after November 19, 1956.

111.50–1(d) *Connections to screw-shell lampholers.* On branch circuits with a grounded conductor, the screw shell of lampholders shall be connected to the grounded neutral.

111.50–1(e) *Through feed arrangements.* Where a feeder supplies more than one distribution panel or panelboard, it may be continuous from the switchboard to the farthest panel or it may be severed at any intermediate panel. If the bus bars of any distribution panel or panelboard carry "through" load, the size of the buses should be designed for the total current. The size of feeder conductors should normally be uniform for the total length but may be reduced at any intermediate distribution panel or panelboard provided that the smallest section of the feeder is protected by the overcurrent device at the distribution switchboard.

111.50–1(f) *Circuits in vicinity of magnetic compass.* Precautions should be taken in connection with apparatus and wiring in the vicinity of the magnetic compass to prevent disturbance of the needle from external magnetic fields.

111.50–5 Ship's service power circuits

111.50–5(a) *Segregation of vital circuits.* Power feeders supplying apparatus required for handling the vessel are not to be used for supplying apparatus which is to be disconnected when the vessel is underway unless the branch circuits for the latter are so arranged that they may be disconnected at panelboards without interfering with the operation or protection of those circuits necessary for the safe operation of the vessel. In general, separate feeders should be run for such groups as engineroom and fireroom auxiliaries, motors for cargo handling gear, radio transmitters, arc searchlights and ventilation sets.

111.50–5(b) *Passenger vessels.* On passenger vessels constructed with firescreen bulkheads forming fire zones, distribution systems shall be so arranged that fire in any main fire zone will not interfere with essential services in any other main fire zone. This requirement will be met if main and emergency feeders passing through any zone are separated both vertically and horizontally as widely as is practicable.

111.50–5(c) *Ventilation systems.* Cargo ventilation fans, machinery spaces ventilation fans, and accommodation ventilation fans shall, if practicable, be supplied by separate feeders. All electrical ventilation systems shall be provided with remote control means for stopping the motors in case of fire or other emergency. For the machinery space ventilation, there shall be provided a control located in the passageway leading to, but outside of, the space. For all other ventilation systems there shall be provided two emergency stop stations. One of these stations shall be in the wheelhouse, fire control room, the inside passageway near the wheelhouse door, or in an accessible position in the passageway leading to, but outside of, the space ventilated. The second emergency stop station shall be located as distant as practicable from the other, except that the ventilation circuit breakers at the main ship's service switchboard may be considered as the second station provided all are grouped together and are conspicuously marked "In Case of Fire Trip To Stop Ventilation." The means provided for stopping ventilation fans from the main ship's service switchboard shall not interfere with power to other circuits. The remote emergency stop stations shall be protected by enclosures with glass paneled doors on the front of which shall be marked "In Case of Fire Break Glass and Operate Switch To Stop Ventilation." Each control switch shall have the "stop" position clearly identified and shall be provided with a nameplate identifying the system with which it is associated. This remote control system shall be of the undervoltage protection type and so arranged that damage to the master switch or cable will automatically stop the fans. For automatic shutdown of mechanical ventilation in spaces protected by a carbon dioxide fire extinguishing system, see Part 34 of Subchapter D (Tank Vessels), Part 76 of Subchapter H (Passenger Vessels), and Part 95 of Subchapter I (Cargo and Miscellaneous Vessels) of this chapter.

111.50–5(c)(1) The requirements of this paragraph shall not be construed to include a closed ventilation system for a motor or generator, diffuser fans for refrigerated spaces, room circulating fans, or exhaust fans for private toilets of an electrical rating comparable to that of room circulating fans.

111.50–5(d) *Steering gear circuits.* Electric and electro-hydraulic steering gear shall be served by two circuits from the ship's service switchboard except in special cases where the length of circuit is very short. One of the circuits may be taken from the emergency switchboard if the rating of the emergency generator is sufficient to supply the steering gear in addition to the emergency loads. The circuits shall be separated throughout their length as widely as practicable. Each circuit shall have adequate current-carrying capacity for supplying all motors and control equipment normally connected to it and which operate simultaneously.

111.50–5(e) *Fuel oil service pump branch circuits.* For remote shutdown requirements for fuel oil service systems, see Part 55 of Subchapter F (Marine Engineering) of this chapter.

111.50–5(f) *Tank vessels.* For special requirements for tank vessels see Subpart 111.70 of this part.

111.50–10 Lighting feeders

111.50–10(a) *Passenger quarters, crew quarters, and public spaces.* On passenger vessels constructed with firescreen bulkheads forming fire zones, the lighting distribution system shall be so arranged that fire in any main fire zone will not interfere with the lighting in any other main fire zone. This requirement will be met if main and emergency feeders passing through any zone are separated both vertically and horizontally as widely as is practicable.

111.50–10(b) *Machinery spaces.* Lighting for enginerooms, for the boilerrooms, and for the auxiliary machinery spaces shall, where practicable, be supplied from two or more feeders, one of which may be an emergency feeder.

111.50–10(c) *Cargo spaces.* Separate feeders shall be provided for cargo space lighting. The distribution panels shall be located outside of the cargo spaces.

111.50–10(d) *Emergency lighting feeders.*

111.50–10(d)(1) For vessels provided with firescreen bulkheads forming fire zones, at least one emergency lighting feeder shall be provided to supply only the emergency lights between two adjacent main vertical fire zone bulkheads. The emergency lighting feeder shall be separated as widely as possible from the general lighting feeder(s) supplying the same space.

111.50–10(d)(2) On vessels fitted with an automatic emergency lighting and power system, a separate emergency lighting feeder shall be provided for emergency lights located in, or controlled from, the wheelhouse. A distribution panel for these lights with a fused switch or circuit breaker for each branch circuit shall be provided. Circuits to navigation lights not controlled by the navigation light panel, signal lights, and emergency lights on open decks, wheelhouse, chart room and fire control room shall be supplied from this wheelhouse distribution panel. The supply to the navigation light indicator panel shall be either a separate circuit from the emergency switchboard or a through feed, without switch or overcurrent protection, from the feeder supplying the wheelhouse emergency lighting panel. For overcurrent protection of the feeder supplying a navigation light panel see Subparagraph 111.55–1(b)(9).

111.50–10(d)(3) On vessels provided with both a temporary and a final emergency lighting source of supply, a separate feeder to the wheelhouse shall be provided for the lifeboat floodlights. This feeder shall supply a distribution panelboard having a fused switch or circuit breaker for each branch circuit. This feeder may be connected to the final emergency lighting source of supply. On vessels without a temporary source of supply, these lights, when provided, may be supplied by the same feeder as other lights controlled from the wheelhouse.

111.50–15 Lighting branch circuits and lighting requirements

111.50–15(a) *General requirements, branch circuits.*

111.50–15(a)(1) *Passageways, public spaces, etc.* The supply to lights in passageways, public spaces, and berthing compartments accommodating more than 25 persons shall be divided between two or more branch circuits one of which may be an emergency.

111.50–15(a)(2) *Machinery spaces.* Where practicable, alternate groups of lights in an engineroom, a boilerroom, and an auxiliary machinery space shall be arranged so that the failure of one branch circuit will not leave large areas in darkness.

111.50–15(a)(3) *Lifeboat floodlights.* The arrangement of branch circuits to lifeboat floodlights required by Paragraph (e) of this section shall be such that the floodlights at adjacent lifeboats are supplied by different branch circuits.

111.50–15(a)(4) *Signaling lamp circuit.* A separate branch circuit shall be provided to supply the signaling lamp(s) required by Subpart 113.60 of this subchapter. The branch circuit shall be supplied either from the emergency lighting panel required by subparagraph (d)(2) or from the final emergency source of emergency lighting and power as provided for in Paragraph 112.15–5(h) of this subchapter, or from a source as approved in the case of vessels not fitted with an emergency lighting and power system.

111.50–15(b) *General lighting requirements.*

111.50–15(b)(1) *Crew spaces and work spaces.* All spaces where members of the crew are regularly employed or quartered shall be adequately lighted. The minimum standard for natural lighting is that it will be possible on a clear day to read print such as that of an ordinary newspaper in any part of the clear working space. When it is not possible to provide adequate natural lighting, artificial lighting may be accepted on the same basis.

111.50–15(b)(2) *Washrooms, toiletrooms, etc.* Washrooms, toiletrooms, and hospital spaces are in particular to be well lighted.

111.50–15(b)(3) *Artificial lighting.* In every space apportioned to the crew, provision shall be made for efficient illumination at night and in dull weather by artificial lighting.

111.50–15(b)(4) *Berth lights.* Special provisions shall be made for berth lights for each member of the crew.

111.50–15(c) *Berth lights.* Berth lights shall be permanently mounted and wired without the use of portable cords. The berth light shall have a minimum horizontal projection so that it will be difficult completely to cover the light with bedding.

111.50–15(d) *Exit lights.*

111.50–15(d)(1) Exit lights are required by section 78.47–40 of Subchapter H (Passenger Vessels) and Part 95 of Subchapter I (Cargo and Miscellaneous Vessels) of this chapter.

111.50–15(d)(2) The word "Exit" shall be in red block letters not less than 2 inches high and of such type that it can be seen from a distance.

111.50–15(e) *Lifeboat floodlights.*

111.50–15(e)(1) Illumination for lifeboat launching operations is required by Part 33 of Subchapter D (Tank Vessels), Part 75 of Subchapter H (Passenger Vessels) and Part 94 of Subchapter I (Cargo and Miscellaneous Vessels) of this chapter.

111.50–15(e)(2) Lifeboat floodlights shall be arranged so that the floodlights may be quickly directed either to the launching gear or to the lifeboat alongside. Means of training the floodlights shall be positive and shall not require the use of tools. The floodlights shall be connected to the supply circuit by means of a short length of heavy duty portable cord, Type S or the equivalent, and no receptacle outlet shall be employed.

111.50–15(e)(3) Vessels having liferafts, authorized in lieu of lifeboats for which approved launching devices are provided, shall be fitted with floodlights for illuminating the liferafts, launching devices, and water into which the liferafts are launched. Such floodlights shall be arranged as required by subparagraph (2) of this paragraph for lifeboats. Means shall also be provided for illuminating the stowage position of liferafts for which approved launching devices are not provided.

111.50–15(f) *Receptacle outlets.*

111.50–15(f)(1) A sufficient number of receptacle outlets shall be located throughout crew's accommodations to permit the use of electric razors, radios, and the like without using portable cords of excessive length.

111.50–15(f)(2) A sufficient number of receptacle outlets shall be located throughout the machinery spaces to permit lighting of any machine vital to the operation of the vessel with a portable light having a 75-foot portable cord. The requirements of this subparagraph shall be effective on vessels contracted for on or after November 19, 1956.

111.50–15(g) *Pilot ladders.* Means shall be provided and used on all vessels engaged on voyages in which pilots are likely to be embarked at night for illuminating the pilot ladders.

111.50–20 Circuit loads and demand factors.

111.50–20(a) *General.* Generator, feeder and bus-tie cables shall be selected on the basis of a computed load of not less than the demand load given in Table 111.50–20(a).

111.50–20(b) *Motor branch circuits.*

111.50–20(b)(1) *General.* The branch circuit cables for motor loads shall be not smaller than No. 14 AWG.

★Table 111.50–20(a)—*Demand loads*

Type of circuit	Demand load
Generator cables	125 percent of continuous generator rating.
Switchboard bus-tie, except ship's service to emergency switchboard bus-tie.	75 percent of generating capacity of the larger switchboard.
Emergency switchboard bus-tie	125 percent of continuous rating of emergency generator.
Feeder supplying two or more motors	125 percent of the rating of the largest motor plus 100 percent of the sum of the ratings of all other motors supplied and including 50 percent of the rating of the spare switches or circuit breakers on the distribution panel.[1]
Feeder supplying two or more cargo winch motors arranged for the "Burtoning" method of cargo handling.	125 percent of the rating of the largest motor plus 35 percent of the sum of the ratings of all other motors supplied.[1]
Feeder supplying two or more 'tween deck cargo winch motors, cargo elevator motors, or cargo cranes.	125 percent of the rating of the largest motor plus 50 percent of the sum of the ratings of all other motors supplied.
Feeder supplying lighting and power transformers.	100 percent of the rated primary line current of the transformer.
Secondary feeders between transformers and distribution point.	100 percent of the rated secondary line current of the transformer.
Galley equipment feeder	100 percent of either the first 50 KW or one-half of the connected load, whichever is the larger, plus 65 percent of the remaining connected load, plus 50 percent of the rating of the spare switches or circuit breakers on the distribution panel.
Lighting feeder	100 percent of the connected load plus the average active circuit load for the spare switches or circuit breakers on the distribution panels.
Grounded neutral of a dual voltage feeder	100 percent of the capacity of the ungrounded conductors when grounded neutral is not protected by a circuit breaker overcurrent trip, or not less than 50 percent of the capacity of the ungrounded conductors when the grounded neutral is protected by a circuit breaker overcurrent trip.

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[1] Where a large number of motors are supplied from one feeder and the character of the load is such that not all motors will be operated simultaneously, a smaller demand load may be approved.

111.50–20(b)(2) *Individual motors.* Branch-circuit conductors supplying a single motor shall have a current-carrying capacity not less than 125 percent of the motor full-load current rating. Minimum cable sizes are given in Table 111.45–20(b3).

111.50–20(b)(3) *Wound-rotor secondary.* The conductors connecting the secondary of a wound-rotor alternating-current motor to its controller shall have a current-carrying capacity not less than 125 percent of the full-load secondary current of the motor. Where the secondary resistor is separate from the controller, the current-carrying capacity of the conductors between the controller and resistor shall be not less than 110 percent of the full-load secondary current.

111.50–20(b)(4) *Several motors.* Conductors supplying two or more motors shall have a current-carrying capacity of not less than 125 percent of the full-load current rating of the highest rated motor in the group plus the sum of the full-load current ratings of the remainder of the motors in the group. Also see Table 111.50–20(a).

111.50–20(b)(5) *Individual multispeed motors.* For multispeed motors the conductors between the controller and the motor windings or winding connections shall have a current-carrying capacity of not less than 125 percent of the full-load current rating of the associated winding or winding connection.

111.50–20(c) *Lighting branch circuits.*

111.50–20(c)(1) *General.* Lighting branch circuit conductors shall be not smaller than No. 14 AWG, except that taps to lampholders within a lighting fixture may be not smaller than No. 18 AWG where the branch circuit is protected by an overcurrent device rated or set at not more than 15 amperes.

111.50–20(c)(2) *15-ampere lighting branch circuits.* The connected load on a lighting branch circuit shall not exceed 12 amperes, computed on the basis of the lamp sizes to be installed, but in no case less than 50 watts per outlet unless the design of the fixture precludes the possibility of installing lamps of a higher wattage than those originally installed. Circuits supplying electric discharge type lamps shall be computed on the basis of ballast input current. Receptacle outlets provided for the convenience of passengers or crew to which no ship's service apparatus, such as room fans, desk lamps, table lamps, etc., will be connected, need not be counted as a connected load.

111.50–20(c)(3) *20-ampere lighting branch circuits.* Lighting branch circuits supplying only fixed nonswitched lighting fixtures for cargo hold or deck lighting may be supplied by 20-ampere branch circuits wired with not less than No. 12 AWG conductors provided all the following conditions are complied with:

111.50–20(c)(3)(i) Fixture wire or portable cord, if employed in the lighting fixtures, shall not be smaller than No. 14 AWG.

111.50–20(c)(3)(ii) The connected load shall not exceed 16 amperes.

111.50–20(c)(4) *30-ampere lighting branch circuits.* Lighting branch circuits supplying only fixed nonswitched lighting fixtures having only lampholders of the mogul type, or other lampholding devices required for lamps exceeding the maximum rating of medium-base lamps (300 watts), may be supplied by 30-ampere branch circuits wired with not less than No. 10 AWG conductors, provided all of the following conditions are complied with:

111.50–20(c)(4)(i) Fixture wire, if employed, in wiring the lighting fixtures, shall be not less than No. 12 AWG.

111.50–20(c)(4)(ii) The connected load shall not exceed 24 amperes.

111.50–20(c)(5) *Multilamp fixtures.* Multilamp fixtures employing a large number of low-wattage lamps, where the total load of the fixture exceeds 12 amperes, may be supplied by a polyphase branch circuit provided all the conditions covered in this subparagraph are complied with.

111.50–20(c)(5)(i) The branch circuit is controlled from the distribution panelboard only by a common closing, common trip, circuit breaker having a pole for each circuit conductor.

111.50–20(c)(5)(ii) The potential between any two conductors of the polyphase circuit does not exceed 120 volts.

111.50–20(c)(5)(iii) The current in any conductor of the polyphase branch circuit does not exceed 12 amperes.

111.50–20(d) *Appliance branch circuits.* Branch circuits which supply appliance loads, electric heater loads, and isolated small motor loads may be connected to distribution panelboards supplying lighting provided the required branch circuit capacity does not exceed 30 amperes.

111.50–20(e) *Low voltage system, 0 to 50 volts.*

111.50–20(e)(1) *Lighting.* Where a low voltage system is used for lighting, standard lamp sockets and receptacles shall be used, and no branch circuit is to be fitted with more than eight lamp sockets or receptacles. Each lighting branch circuit shall be wired with not less than No. 12 AWG conductors, and shall be protected by fuses of no greater capacity than 20 amperes, except that special circuits supplying appliances shall have receptacles of 20-ampere rating and shall be wired with not less than No. 10 AWG. Where a low voltage, low amperage system is used, such as for interior communication, no electrical connection is to be made to a standard voltage system unless specifically approved.

111.50–20(e)(2) *Engine starting.* Battery systems for engine starting purpose may be of the one-wire system. The ground lead shall be carried to the engine frame. Means shall be provided for removing the ground from the battery while the battery is being charged.

111.55 OVERCURRENT PROTECTION

111.55–1 Installation of overcurrent devices

111.55–1(a) *General requirements.* Overcurrent protection for conductors is provided for the purpose of opening the electric circuit if the current reaches a value which will cause an excessive or dangerous temperature in the conductor or conductor insulation. A grounded conductor is considered to be protected from overcurrent if a protective device of a suitable rating or setting is provided in each ungrounded conductor of the same circuit, except as otherwise required by Paragraph (d) of this Section. For the minimum size of the grounded neutral conductor of a multiwire feeder see Table 111.50–20(a).

111.55–1(b) *Overcurrent protection of conductors.* Conductors shall be protected in accordance with their current-carrying capacities, as given in Tables 111.60–1(e)(1)(i) and 111.60–1(e)(1)(ii), except as follows:

111.55–1(b)(1) *Fuses.* If the allowable current-carrying capacity of the conductor does not correspond to a standard size fuse, the next larger size or rating may be used but not exceeding 150 percent of the allowable current-carrying capacity of the conductor. Plug fuses and fuseholders (see Paragraph 111.55–15(b)) shall not be used in circuits exceeding 125 volts between conductors. The screw shell of plug type fuseholders shall be connected to the load of the circuit.

111.55–1(b)(2) *Circuit breakers.* If the allowable current carrying capacity of the conductor does not correspond to a standard rating of circuit breakers, the next larger rating may be used but not exceeding 150 percent of the allowable current-carrying capacity of the conductor. The effect of the temperature on the operation of thermally-controlled circuit breakers should be taken into consideration in the application of such circuit breakers when they are subjected to extremely low or extremely high temperatures.

111.55–1(b)(3) *Fixture wires or flexible cords.* Fixture wire or flexible cord, size No. 16 or No. 18 AWG, shall be considered as protected by 15-ampere overcurrent devices.

111.55–1(b)(4) *Motor branch circuits.* The conductors of motor branch circuits shall be considered as protected by the overcurrent protective devices specified by Paragraphs 111.45–5 (b) through (g), and Section 111.45–20.

111.55–1(b)(5) *Motor feeder circuits.* The conductor of motor feeder circuits shall be considered as protected by the overcurrent devices specified by Paragraph 111.45–25(b).

111.55–1(b)(6) *Remote-control, electrical interlock, and indicator circuits.* The conductors of remote control, electrical interlock, and indicator circuits of motor controllers shall be considered as protected by the arrangements specified by Paragraph 111.45–10(b).

111.55–1(b)(7) *Appliance branch circuits.* The rating or setting of branch circuit overcurrent devices shall not be in excess of the current-carrying capacity of the circuit conductors except as provided in subparagraphs (1) and (2) of this paragraph. If the circuit supplies only a single appliance or device, the rating or setting of the branch circuit overcurrent device shall not exceed 150 percent of the rating of the appliance or device or 15 amperes whichever is the higher.

111.55–1(b)(8) *Lighting branch circuits.* Lighting branch circuits shall be protected against overcurrent either by fuses or by circuit breakers rated or set at not more than 15 amperes, except that 20-ampere lighting branch circuits complying with the provisions of Subparagraph 111.50–20(c)(3) may be protected by overcurrent devices rated or set at no more than 20 amperes, and 30-ampere lighting branch circuits complying with the provisions of Subparagraph 111.50–20(c)(4) may be protected by overcurrent devices rated or set at not more than 30 amperes, and low voltage lighting branch circuits may be protected in accordance with Paragraph 111.50–20(e).

111.55–1(b)(9) *Navigation light circuits.* The feeder supplying a navigation light panel shall be protected by overcurrent devices rated or set at not less than 30 amperes. The navigation light panel shall be fitted with 10-ampere main fuses and with 3-ampere branch circuit fuses as indicated on Figure 113.55–25(b) of this subchapter.

111.55–1(b)(10) *Steering gear circuits.* For overcurrent protection of steering gear branch circuits, see Paragraph 111.45–20(h).

111.55–1(c) *Thermal devices.* Thermal cutouts, thermal relays and other devices not designed to open short circuits, shall not be used for protection of conductors against overcurrent due to short circuits or grounds, but may be used to protect motor branch circuit conductors from overload if said devices are protected in accordance with Paragraph 111.45–5(m).

111.55–1(d) *Ungrounded conductors.* An overcurrent device (fuse or overcurrent trip unit of a circuit breaker) shall be placed in each ungrounded conductor, except that, on systems having a grounded neutral, a 2-wire branch circuit consisting of one ungrounded conductor and the grounded neutral conductor shall have overcurrent protection in each conductor. In such cases, the grounded neutral overcurrent device shall comply with Paragraph (f) of this section. A branch or feeder switch or circuit breaker shall open all conductors of the circuit. Individual single-pole circuit breakers with operating handles yoked together may be used for the protection of each conductor of ungrounded 2-wire circuits.

111.55–1(e) *Motors.* For motor-running protection the number of overcurrent units shall be as specified in Paragraphs 111.45–5 (i), (j), and (k).

111.55–1(f) *Grounded conductor.* No overcurrent device shall be placed in any permanently grounded conductor, except as permitted in this paragraph.

111.55–1(f)(1) *Simultaneous opening.* When the overcurrent device simultaneously opens all conductors of the circuit.

111.55–1(f)(2) *Motor-running protection.* For motor-running protection as provided in Paragraphs 111.45–5 (i) and (j).

111.55–1(g) *Protection of ship's service generators.*

111.55–1(g)(1) *General.* Each generator of 25 kw. and over, and each generator regardless of size if arranged for parallel operation shall be protected by an individual trip-free air circuit breaker having inverse time overcurrent trips. The pickup setting of the long time overcurrent trip of the circuit breaker shall not exceed 115 percent of the generator rating for continuous rated machines and shall not exceed 15 percent above the overload rating for special rated machines. Each generator of less than 25 kw. not arranged for parallel operation may be protected by individual fuses in lieu of an individual circuit breaker.

111.55–1(g)(2) *Alternating current generators.* Where three or more generators are arranged for parallel operation, the circuit breakers shall have, in addition to inverse time trips, instantaneous trips set at a value in excess of the maximum asymmetrical short circuit current available from the associated generator. In order to provide the optimum degree of protection for generators, the short time trips shall be set at the lowest values of current and time which will coordinate with the trip settings of feeder circuit breakers supplied by the generator to provide the continuity of service and high speed clearance specified in Section 111.55–25.

111.55–1(g)(3) *Direct current generators.* In addition to the inverse time overcurrent trips, direct current generator circuit breakers shall be provided with an instantaneous trip set at the lowest value of current which will coordinate with the trip settings of feeder circuit breakers supplied by the generator to provide the continuity of service and high speed clearance specified in Section 111.55–25.

111.55–1(g)(4) *Generator circuits for parallel operation.* Each direct-current generator arranged for parallel operation shall be provided with a reverse current device. Each alternating-current generator arranged for parallel operation shall be provided with a reverse power relay.

111.55–1(h) *Three-wire direct-current generators.*

111.55–1(h)(1) *Circuit-breaker poles.* Separate circuit-breaker poles should be provided for the positive, negative, neutral and also for the equalizer leads unless protection is provided by the main poles. When equalizer poles are provided for the three-wire generators, the overload trips should be of the "Algebraic" type. No overload trip should be provided for the neutral pole, but it should operate simultaneously with the main poles. A neutral overcurrent relay and alarm system should be provided and set to function at a current value equal to the neutral rating.

111.55–1(h)(2) *Equalizer buses.* For three-wire generators the circuit breaker shall protect against a short circuit on the equalizer buses.

111.55–1(h)(3) *Neutral grounding, main switchboard.* The neutral of three-wire dual-voltage direct-current systems should be solidly grounded at the generator switchboard with a zero center ammeter in the ground connection. The zero center ammeter shall have a full-scale reading of 150 percent of the neutral current rating of the largest generator and be marked to indicate the polarity of grounds. The ground connection should be made in such a manner that it will not prevent checking the insulation resistance of the generator to ground before the generator is connected to the bus. The neutral of three-wire direct-current emergency power systems should be grounded at all times when supplied from the emergency generator or storage battery.

111.55–1(h)(4) *Neutral grounding, emergency switchboard.* No direct ground connection should be provided at the emergency switchboard, the neutral bus or buses being solidly and permanently connected to the neutral bus of the main switchboard. No interrupting device should be provided in the neutral conductor of the bus-tie feeder connecting the two switchboards.

111.55–1(i) *Three-wire single-phase and four-wire three-phase generators.*

111.55–1(i)(1) *Circuit-breaker poles.* Circuit-breaker poles shall be provided for each generator lead, including the neutral, except that where the generator disconnect switch is operable from the front of the switchboard, no generator circuit-breaker pole need be provided for the generator neutral.

111.55–1(i)(2) *Neutral grounding, main switchboard.* The neutral of dual-voltage alternating-current systems shall be solidly grounded at the generator switchboard with an ammeter in the ground connection. The ground connection shall be made in such a manner that it will not prevent checking the insulation resistance of the generator to ground before the generator is connected to the bus. The neutral of dual-voltage alternating-current emergency lighting and power systems shall be grounded at all times when supplied from the emergency generator or storage battery.

111.55–1(i)(3) *Neutral grounding, emergency switchboard.* The neutral bus of the emergency switchboard shall be grounded in the same manner as described for three-wire direct-current systems in paragraph (h)(4) of this section.

111.55–1(j) *Propulsion circuits.* Overcurrent protection of propulsion motors, generators, and circuits will require special consideration in each case. For general requirements see Paragraph 111.35–25(j).

★111.55–1(k) *Transformer feeder circuits.* The conductors of transformer primary and secondary feeder circuits shall be provided with short circuit protection and shall be protected by overcurrent devices located at the source of supply to the primary, rated or set at 100 percent of the smaller of the primary and secondary feeder conductors (taking into account the transformer ratio as necessary). The rating or setting of the overcurrent devices shall not exceed 115 percent of the rated primary current of the transformer.

111.55–5 Location of overcurrent protective devices

111.55–5(a) *Location in circuit.* Overcurrent devices shall be located at the point where the conductor to be protected receives its supply, except as covered in this paragraph.

111.55–5(a)(1) The overcurrent protective device for generator conductors shall be located on the generator switchboard.

111.55–5(a)(2) The overcurrent protection for shore connection conductors shall be located on the switchboard to which connected.

111.55–5(a)(3) If the overcurrent device protecting the larger conductors also protects the smaller conductors in accordance with Tables 111.60–1(e)(1)(i) and 111.60–1(e)(1)(ii).

111.55–5(a)(4) If (i) the smaller conductors have a current-carrying capacity of not less than the sum of the allowable current-carrying capacities for the conductors of the one or more circuits or loads supplied, and (ii) the tap is not over 5 feet long and does not extend beyond the switchboard, panelboard, or control device which it supplies.

111.55–5(a)(5) If the smaller conductors have a current-carrying capacity at least one-third that of the conductor from which they are supplied, and provided the tap is suitably protected from mechanical injury, is not over 25 feet long, and terminates in a single circuit breaker or set of fuses which will limit the load on the tap to that allowed by Tables 111.60–1(e)(1)(i) and 111.60–1(e)(1)(ii). Beyond this point the conductors may supply any number of circuit breakers or sets of fuses.

111.55–5(b) *Location on vessel.* Overcurrent devices shall be located where they will be readily accessible; not exposed to mechanical injury; not in the vicinity of easily ignitible material nor where explosive gas or vapor may accumulate; and, preferably in combination with distribution panelboards, switchboards, motor controllers, etc.

111.55–10 Enclosures for overcurrent protective devices

111.55–10(a) *General.* Overcurrent devices shall be enclosed in metal boxes or cabinets, unless a part of a specially approved assembly which affords equivalent protection, or unless mounted on switchboards, panelboards, or controllers located in compartments or enclosures free from easily ignitible material and accessible only to qualified persons. The operating handle of a circuit breaker may be accessible without opening a door or cover.

111.55–10(b) *Exposed to weather.* Enclosures for overcurrent devices shall not be installed in locations exposed to the weather, unless unavoidable, in which case the enclosure shall be watertight.

111.55–10(c) *Disconnection of fuses and thermal cutouts.* Disconnecting means shall be provided on the supply side of and adjacent to all cartridge fuses or thermal cutouts so that each individual circuit containing fuses or thermal cutouts can be independently disconnected from the source of electrical energy except as indicated in this paragraph.

111.55–10(c)(1) Instrument fuses located on switchboards operating at potentials not exceeding 600 volts need not have a disconnecting device provided a fuse puller is available.

111.55–10(c)(2) A single disconnecting means may be used to disconnect a group of circuits each protected by fuses or thermal cutouts under the conditions described in Paragraph 111.45–30(o).

111.55–10(c)(3) No disconnect means shall be provided for general alarm feeders and branch circuits covered by Paragraph 113.25–10(b).

111.55–10(d) *Arcing or suddenly-moving parts.* Arcing or suddenly-moving parts shall comply with the requirements of this paragraph.

111.55–10(d)(1) Fuses and circuit breakers shall be so located or shielded that persons will not be burned or otherwise injured by their operation.

111.55–10(d)(2) Handles or levers of circuit breakers, and similar parts which may move suddenly in such a way that persons in the vicinity are liable to be injured by being struck by them, shall be guarded or isolated.

111.55–15 Construction and use of overcurrent devices

111.55–15(a) *Fuse types prohibited.* Plug fuses of the Edison-base type and renewable link cartridge type fuses shall not be used.

★111.55–15(b) *Plug fuses and fuseholders of Type S.* Plug fuses and fuseholders of Type S may be employed for applications at not over 125 volts; 0 to 15 amperes, 16 to 20 amperes, and 21 to 30 amperes.

111.55–15(c) *Cartridge fuses and fuseholders.* National Electrical Code Standard, nonrenewable cartridge fuses may be used for applications not exceeding 600 volts, 0 to 600 amperes. Special cartridge fuses may be used in instruments and the like when specifically approved.

★ 111.55–15(d) *Construction and marking of fuses.* Fuses shall be constructed in accordance with Underwriters' Laboratories, Inc., Standard for Fuses. Standard cartridge fuses shall be marked with the label of Underwriters' Laboratories, Inc. Special cartridge fuses shall be inspected under Underwriters' Laboratories, Inc., reexamination service.

111.55–15(e) *Circuit breakers.* Circuit breakers shall conform to the requirements contained in this paragraph.

111.55–15(e)(1) *Method of operation.* In general, circuit breakers shall be capable of being closed or opened by hand without employing any other source of power, although normal operation may be by other power, such as electrical, pneumatic, and the like. Large circuit breakers which are to be closed and opened by electrical, pneumatic, or other power shall be capable of being closed by hand for maintenance purposes and shall also be capable of being tripped by hand under load without the use of power.

111.55–15(e)(2) *Injury to operator.* Circuit breakers shall be arranged and mounted so that their operation is not likely to injure the operator.

111.55–15(e)(3) *Indication.* Circuit breakers shall indicate whether they are in the open or closed position.

111.55–15(e)(4) *Nontamperable.* An air circuit breaker, used for branch circuits, shall be of such design that any alteration of its trip point (calibration), or in the time required for its operation, will be difficult.

111.55–15(e)(5) *Marking.* Circuit breakers shall be marked with their rating in such a manner that the marking will be visible after installation.

111.55–15(e)(6) *Construction and interrupting rating.* The construction and rating of feeder and branch-circuit circuit breakers rated not more than 600 amperes and not more than 600 volts shall conform with the requirements of Underwriters' Laboratories, Inc., "Standard for Branch Circuit and Service Circuit Breakers" except as indicated in this subparagraph.

111.55–15(e)(6)(i) Circuit breakers installed in enginerooms, boilerrooms and auxiliary machinery spaces shall be calibrated for an ambient temperature of 50° C. and circuit breakers so calibrated may be used in other locations.

111.55–15(e)(6)(ii) Circuit breakers with interrupting ratings of over 10,000 amperes may be rated in accordance with the National Electrical Manufacturers Association's "Large Circuit Breaker Standard" or "Molded Case Circuit Breaker Standard," as applicable.

111.55–15(e)(7) *Removable from front.* Circuit breakers of the molded case type when installed on generator or distribution switchboards shall be mounted or arranged in such a manner that the circuit breaker may be removed from the front without first disconnecting copper or cable connections or deenergizing the supply.

111.55–20 Interrupting rating of fuses and circuit breakers

111.55–20(a) *General.* Any circuit breaker or fuse installed at a point in the circuit where the maximum possible short-circuit current exceeds its interrupting rating shall be backed up by either, a circuit breaker of adequate interrupting rating with an instantaneous trip setting not more than 90 percent of the interrupting rating of the device protected, or by a suitable current limiting fuse. The backup breaker or fuse nearest the source of power shall have an interrupting rating not less than the maximum short-circuit current available at the point where it is installed.

111.55–20(a)(1) *Current limiting fuses.* If a fuse is used as a backup device, its selection and application shall be governed by the following design parameters:

111.55–20(a)(1)(i) The maximum fuse rating shall be selected which will give adequate protection, on fault currents, to the device it backs up. In no case shall the device being backed up be called upon to interrupt fault currents in excess of 90 percent of its interrupting rating.

111.55–20(a)(1)(ii) Fault currents cleared by the device backed up shall not cause damage or any change in the time-current characteristics of the current limiting fuse.

111.55–20(a)(1)(iii) Fuses should be so applied that single phase operation of any three-phase connected motor will be precluded.

111.55–20(a)(2) *Fused circuit breakers.* Fused circuit breakers with fuses connected to the load side may be used for backup service provided the fuses and circuit breakers are of coordinated design so that arc restrike in the circuit breaker cannot occur when a fuse blows.

111.55–20(b) *Generator circuit breaker as backup circuit breaker.* Generator circuit breaker(s) shall not serve as the backup circuit breaker(s) for distribution or feeder circuit breakers.

111.55–20(c) *Calculation of short-circuit currents.* Unless precise calculations are submitted for review, the maximum short-circuit current of a direct-current system will be assumed to be equal to ten times the combined normal rated current of all generators (including a spare) plus six times the combined normal rated current of all motors which may be in operation simultaneously. On alternating-current systems, the maximum short-circuit current will be assumed to be equal to ten times the combined normal rated current of all generators (including a spare) plus three times the combined normal rated current of all motors which may be in operation simultaneously.

111.55–25 System protection

111.55–25(a) *General.* Insofar as is possible, the selection, arrangements and performance of the various overcurrent protective devices should be made with the following objectives in mind as described in this paragraph:

111.55–25(a)(1) *Continuity of service.* Continuity of service under short-circuit conditions through the selective operation of the various protective devices.

111.55–25(a)(2) *High speed clearance.* High speed clearance of low impedance short circuits in order that short-circuit currents of large magnitude will cause minimum damage to the system and equipment and minimize the hazard of fire.

111.60 WIRING METHODS AND MATERIALS

111.60–1 Electric cable

111.60–1(a) *General.* The intent and purpose of this section is to provide that conductors shall have mechanical strength, insulation, and current-carrying capacity adequate for the particular conditions under which they are used.

111.60–1(b) *Construction.* Electric cables shall be constructed and tested by the manufacturer in accordance with the requirements of Section 18, IEEE Standard No. 45.

111.60–1(b)(1) *Classes of cables.* The classes of cables covered by this standard are:

111.60–1(b)(1)(i) Lighting and power cables.

111.60–1(b)(1)(ii) Interior communication and telephone cable.

111.60–1(b)(1)(iii) Inter-cabin telephone cable.

111.60–1(b)(1)(iv) Bell wire.

111.60–1(b)(1)(v) Switchboard wire.

111.60–1(b)(2) *Cable classes by type of insulation.* The above cables are classed in accordance with the type of conductor insulation as:

111.60–1(b)(2)(i) Rubber insulated.

111.60–1(b)(2)(ii) Varnished-cambric insulated.

111.60–1(b)(2)(iii) Asbestos-varnished-cambric insulated.

111.60–1(b)(2)(iv) Thermoplastic-asbestos insulated.

111.60–1(b)(2)(v) Mineral insulated, Type MI.

111.60–1(b)(3) *Cable classes by type of mechanical covering.* The above cables are classed in accordance with the type of mechanical covering as:

111.60–1(b)(3)(i) Armored.

111.60–1(b)(3)(ii) Leaded and armored.

111.60–1(b)(3)(iii) Impervious sheathed and armored.

111.60–1(b)(3)(iv) Reinforced rubber sheathed and armored.

111.60–1(b)(3)(v) Braided (applicable only to bell wire and switchboard wire).

111.60–1(b)(3)(vi) Mineral insulated metal sheathed, Type MI.

111.60–1(c) *Cable marking.* Cable complying with the requirements of this section shall be identified by providing a marker tape under the cable sheath. The marker tape shall give at regular and frequent intervals: (1) manufacturer, (2) applicable specification, and (3) year of manufacture.

111.60–1(d) *Cable applications.*

111.60–1(d)(1) *Damp or wet locations.* Electric cable for installation in damp or wet locations shall be leaded and armored, reinforced rubber sheathed and armored, impervious sheathed and armored, or mineral insulated-metal sheathed. The cable insulation may be either rubber, varnished-cambric, asbestos-varnished-cambric, thermoplastic-asbestos or mineral insulated, type MI, except that rubber insulated power and lighting cable shall not be used in locations where the ambient temperature exceeds 50 degrees C.

111.60–1(d)(2) *Corrosive locations.* The armor of cables in corrosive locations shall be either bronze or aluminum and the sheath on mineral insulated-metal sheathed cables shall be seamless annealed copper.

111.60–1(d)(3) *Dry locations.* Cables for installation in dry locations shall be either rubber insulated and armored or any of the cables specified in Subparagraph (1) of this paragraph for damp or wet locations.

111.60–1(d)(4) *Power and lighting cable.* Cable for power and lighting applications shall be power and lighting cable of the types described in this subpart except that 600-volt thermoplastic-asbestos insulated interior communication cable may be used in control and indicating circuits of power and lighting equipment.

111.60–1(d)(5) *Interior communication and telephone cable.* Cable for interior communication apparatus operating on potentials not exceeding 300 volts shall be either interior communication cable, telephone cable, or power and lighting cable of the types described in this subpart.

111.60–1(d)(6) *Inter-cabin telephone cable.* Inter-cabin telephone cable may be used for telephone systems installed for the convenience of passengers or crew and not essential for the operation of the vessel.

111.60–1(d)(7) *Bell wire.* Bell wire may be used for call bell circuits of 25 volts or less installed for the convenience of passengers or crew if properly installed in protected raceways.

111.60–1(d)(8) *Switchboard wire.* Switchboard wire may be used only on switchboards, motor controllers and the like.

111.60–1(e) *Current-carrying capacity.*

111.60–1(e)(1) *General.* The maximum current-carrying capacities of electric lighting and power cables for continuous service are given in Tables 111.60–1(e)(1)(i) and 111.60–1(e)(1)(ii). The maximum current-carrying capacity of interior communication cable is 7.5 amperes.

111.60–1(e)(2) *Conductors in multiple.* Conductors may be run in multiple provided they are of the same length and have the same circular mil area and type of insulation. Where conductors are run in multiple, they shall be arranged and terminated at both ends in such a manner as to insure equal division of the total current between all conductors that are involved.

111.60–1(f) *Temperature limitation.* No cable shall be used under such condition that its temperature, even when carrying current, will exceed the temperatures specified in Table 111.60–1(e)(1)(i) for the type of insulation involved.

111.60–1(g) *Conductor size for varnished-cambric insulated cables.* Varnished-cambric insulated power and lighting cables in sizes smaller than No. 12 AWG shall not be used. Rubber or asbestos-varnished-cambric insulated power and lighting cables may be used in size No. 14 AWG and larger.

★ 111.60–1(h) *Substitute cable.* Electric cable constructed in accordance with Military Specifications MIL–C–915 or MIL–C–2194 may be substituted for the equivalent AIEE type cable specified in this section. The maximum current for any conductor shall not exceed the current-carrying capacities specified in the publication “Cable Comparison Guide,” NavShips 250–660–23.

★ 111.60–1(i)(1) *Special purpose cable*—(1) *Instrumentation cable.* Electric cable constructed in accordance with Military

TABLE 111.60–1(e)(1)(i)—*Wires and cables*[1]*—Maximum current-carrying capacities, direct-current, for continuous service, 50 degrees C. ambient*[2,3] *(concentric stranding, 600 volts*[4] *or less, direct-current) (alternating-current ratings for cables are the same as given for direct-current up to 700,000 circular mils; for 700,000 circular mils and above, see Table 111.60–1(e)(1)(ii))*

Conductor size		Current in amperes											
		1-conductor				2-conductor				3-conductor			
Area (circular mils)	Nearest AWG	R	VC	AVC	MI	R	VC	AVC	MI	R	VC	AVC	MI
2,000,000	----------	1,048	1,380	1,538	----------	----------	----------	----------	----------	----------	----------	----------	----------
1,750,000	----------	934	1,231	1,373	----------	----------	----------	----------	----------	----------	----------	----------	----------
1,500,000	----------	846	1,095	1,228	----------	----------	----------	----------	----------	----------	----------	----------	----------
1,250,000	----------	743	970	1,020	----------	----------	----------	----------	----------	----------	----------	----------	----------
1,000,000	----------	640	831	925	----------	----------	----------	----------	----------	----------	----------	----------	----------
950,000	----------	617	812	904	----------	----------	----------	----------	----------	----------	----------	----------	----------
900,000	----------	592	779	866	----------	----------	----------	----------	----------	----------	----------	----------	----------
850,000	----------	578	752	838	----------	----------	----------	----------	----------	----------	----------	----------	----------
800,000	----------	557	725	807	----------	----------	----------	----------	----------	----------	----------	----------	----------
750,000	----------	538	696	776	----------	----------	----------	----------	----------	----------	----------	----------	----------
700,000	----------	516	666	741	----------	----------	----------	----------	----------	----------	----------	----------	----------
650,000	----------	486	623	694	----------	382	503	560	----------	331	428	476	----------
600,000	----------	466	597	665	----------	363	481	535	----------	317	407	452	----------
550,000	----------	441	563	627	----------	344	462	514	----------	302	386	428	----------
500,000	----------	418	534	594	----------	323	431	480	----------	285	367	408	----------
450,000	----------	392	498	554	----------	306	406	452	----------	265	341	379	----------
400,000	----------	369	464	516	----------	284	377	418	----------	248	319	354	----------
350,000	----------	340	429	477	----------	261	351	390	----------	230	294	327	----------
300,000	----------	301	389	432	----------	238	315	351	----------	209	267	297	----------
250,000	----------	270	348	387	----------	212	281	312	----------	186	238	264	----------
212,000	4/0	241	310	345	308	193	254	283	----------	169	215	239	----------
168,000	3/0	208	273	304	264	167	223	248	----------	148	187	208	----------
133,000	2/0	180	237	264	228	145	194	214	----------	130	163	181	----------
106,000	1/0	155	206	229	196	128	170	189	----------	112	142	158	----------
83,700	1	133	177	197	168	111	148	165	----------	98	122	135	----------
66,400	2	115	152	169	144	96	128	142	----------	86	106	118	----------
52,600	3	99	132	147	124	85	111	124	----------	75	92	102	----------
41,700	4	85	114	127	108	74	97	108	72	66	80	89	72
33,100	5	71	99	110	94	64	85	95	63	57	70	78	63
26,300	6	63	86	96	80	56	74	82	56	49	61	67	56
20,800	7	54	74	82	----------	49	64	71	----------	44	52	58	----------
16,500	8	46	66	73	56	42	55	61	40	39	46	51	40
10,400	10	34	49	54	44	32	42	47	32	29	35	39	32
6,530	12	24	32	35	32	22	27	30	24	21	23	26	24
4,110	14	15	----------	20	24	14	----------	19	20	13	----------	17	20

[1] The values given in this table may be used provided the cable installation is limited to double banking. Where this limitation is exceeded, the values given in this table shall be decreased 5 percent for each additional bank.

[2] The values given in this table are based upon an ambient temperature of 50 degrees C and maximum conductor temperatures of:
75 degrees C for rubber (R) insulated cables;
85 degrees C for varnished-cambric (VC) insulated cables; mineral insulated (MI) cables; and
95 degrees C for asbestos-varnished-cambric (AVC) insulated cables.

[3] If ambient temperatures differ from 50 degrees C the value shown above shall be multiplied by the following factors:

Type of cables	Ambient temperature		
	40° C	60° C	70° C
Rubber insulated cables	1.18	----------	----------
Varnished-cambric insulated cables and mineral-insulated cables	1.13	0.84	----------
Asbestos-varnished-cambric insulated cables	1.11	0.88	0.75

[4] For voltages greater than 600 volts, current rating shall be decreased 2 percent for each thousand volts increase over 600 volts.

Specifications MIL–C–915, MIL–C–2194 or MIL–C–23206 of the types TTHFWA, TTRSA, PI, 1SWA, 2SWA, 3SWA, may be used for instrumentation circuits to connect such items as indicator lights, sensors, selector switches, and pushbuttons where the voltage of the circuit does not exceed 100 volts. The maximum current for any conductor shall not exceed the current-carrying capacities specified in the publication "Cable Comparison Guide," NavShips 250–660–23.

111.60–1(i)(2) *Thermocouple cable.* Electric cable constructed in accordance with Military Specification MIL–C–915 of the types PBJX, PBTM and PBTX may be used as conductors between thermocouple sensors and their registering equipment.

111.60–1(i)(3) *Other types of cable.* Other types of cable will be given special consideration by the Commandant where the cable does not penetrate a watertight bulkhead and is suitably protected from mechanical damage.

111.60–5 Portable electric cord and fixture wire

111.60–5(a) *General.* The construction of portable electric cords and fixture wire shall be in accordance with Underwriters' Laboratories, Inc., Standard for Flexible Cord and Fixture Wire.

111.60–5(b) *Application, portable cords.* Portable cords may be used only for the connection of portable lamps or appliances and for the connection of stationary lamps or small station-

TABLE 111.60–1(e)(1)(ii)[1]—*Wires and cables—Maximum current-carrying capacities, alternating current for continuous service (values are in amperes—600 volts or less). (Alternating-current ratings for cables of less than 700,000 circular mils are the same as those for cables given in Table 111.60–1(c)(1)(i))*

60-CYCLE ALTERNATING CURRENT					
Conductor size	Concentrically stranded conductor			Annular conductor	
Area in circular mils	Rubber insulated	Varnished-cambric insulated	Asbestos-varnished-cambric insulated	Varnished-cambric insulated	Asbestos-varnished-cambric insulated
2,000,000	932	1,229	1,440	1,417	1,590
1,750,000	864	1,125	1,305	1,294	1,450
1,500,000	791	1,023	1,199	1,160	1,315
1,250,000	719	920	1,070	1,021	1,150
1,000,000	631	808	925	877	990
950,000	609	790	899	840	955
900,000	587	760	867	803	920
850,000	568	735	838	777	885
800,000	548	711	803	747	848
750,000	529	683	775	708	810
700,000	509	656	740	675	775

[1] Footnotes 1, 2, 3, and 4 of Table 111.60–1 (e) (1) (i) are applicable to this table.

ary equipment not suitable for fixed wiring. When used they shall be of the type indicated in Table 111.60–5(b). Types of portable cords other than those listed in Table 111.60–5(b) and the uses for the types listed other than those uses permitted by this paragraph shall be subject to special investigation and shall not be employed before being approved.

111.60–5(b)(1) *Damp or wet locations or for hard service.* Portable cords for use in damp or wet locations or for hard service shall be type S, SO, ST, SJ, SJO, SJT, HS, HSJ, AFS, or AFSJ, and portable cords for use where exposed to oil or oil vapor shall be type SO or SJO.

111.60–5(b)(2) *Dry locations.* Portable cords for use in dry locations and not for hard services shall be type C, P, P–2, PD, PW, PW–2, K, HC, HPD, AVPD, or one of the types listed for damp or wet locations in subparagraph (1) of this paragraph.

111.60–5(b)(3) *Extra hard service.*

TABLE 111.60–5(b)—*Portable cords*

Trade name	Type letter (National Electrical Code)	Maximum voltage	Conductor insulation	Braid on each conductor	Cord outer covering	Maximum temperature °C.	Use	
Lamp cord	C	300	Rubber	Cotton	None	60	Dry places	Not hard usage.
Twisted portable cord.	PD	300	do	do	Cotton or rayon	60	do	Do.
Reinforced cord	P–2 P	300 600	do	do	Cotton over rubber filler	60	do	Do.
Moistureproof reinforced cord.	PW–2 PW	300 600	do	do	Cotton, moisture-resistant finish over rubber filler.	60	do	Do.
Braided heavy duty cord.	K	300	do	do	Two cotton, moisture-resistant finish.	60	do	Do.
Junior hard service cord.	SJ SJO SJT	300	do Thermoplastic or rubber.	None	Rubber Oil-resistant compound Thermoplastic	[1] 60	Damp places	Hard usage.
Hard service cord	S SO ST	600	Rubber Thermoplastic or rubber.	do	Rubber Oil resistant compound Thermoplastic	60	do	Extra hard usage.
Heater cord	HC HPD	300	Rubber and asbestos	Cotton None	None Cotton or rayon	90	Dry places	Not hard usage.
Rubber-jacketed heater cord.	HSJ	300	do	do	Cotton and rubber	[2] 90	Damp places	Hard usage.
Jacketed heater cord.	HS	300	do	do	Cotton, and rubber or neoprene.	[2] 90	do	Do.
Heat- and moisture-resistant cord.	AVPD	300	Asbestos and varnished cambric.	do	Asbestos, flame-retardant, moisture resistant.	110	Dry places	Not hard usage.
Rubber-jacketed heat-resistant cord.	AFSJ, AFS	300	Impregnated asbestos.	do	Rubber	[2] 150	Damp places	Hard usage.
Elevator cable	E EO ET	300	Rubber Thermoplastic	Cotton Rayon	Three cotton, outer one flame-retardant, moisture-resistant.[3] One cotton and neoprene jacket.[3] Three cotton, outer one flame-retardant, moisture-resistant.[3]	60	Elevator lighting and control.	

[1] The temperature limit for Type SJ, SJO, or SJT cord is 75° C instead of 60° C if both the conductor insulation and jacket employ compounds which are recognized as suitable for use at 75° C. Such cords are recognized specifically for use on electric refrigerators or in similar applications on appliances where cord replacement is not a problem. Such cords shall be marked by having a green thread (which indicates a temperature limit or 75° C) either immediately under the insulation or under the separator of one conductor.

[2] The temperature limit indicated applies only to the individual conductors where the cord is employed within an appliance. The temperature limit on the jacket of Type HS rubber-jacketed heater cord and Type AFS or AFSJ rubber-jacketed heat-resistant cord is limited to 75° C. The temperature limit on the jacket of Type HSJ rubber-jacketed heater cord is limited to 60° C. unless the jacket is marked by means of indent printing or indelible-ink printing at intervals of two feet or less with the value "75° C."

[3] Rubber-filled or varnished-cambric tapes may be substituted for the inner braids.

Portable cords for use in damp or wet locations and requiring a length in excess of 5 feet shall be type S, SO, or ST.

111.60–5(c) *Allowable current-carrying capacity.* The allowable current-carrying capacities of flexible cord and fixture wire are given in Table 111.60–5(c).

111.60–5(d) *Conductor size.* Portable cord or fixture wire shall not be smaller than No. 18 AWG.

111.60–5(e) *Splices.* Portable cords shall be used only in continuous lengths without splices or taps.

111.60–5(f) *Pull at joints and terminals.* Portable cords shall be so connected to devices and to fittings that tension will not be transmitted to joints or terminal screws. This shall be accomplished by a knot in the cord, winding with tape, by a special fitting designed for that purpose, or by other equivalent means.

111.60–5(g) *Fixture wire, application.* Fixture wire may be used in the interior of lighting fixtures, instruments, and the like. When used, fixture wire shall be one of the types covered in this paragraph.

111.60–5(g)(1) Either type AF, SF–2, or SFF–2 fixture wire shall be used for applications where the temperature will exceed 90° C. and for the wiring of all mogul-base screw-shell lampholders.

111.60–5(g)(2) Either type AF, SF–2, or SFF–2 fixture wire shall be used for wiring lighting fixtures provided with other than mogul-base screw-shell lampholders, except that type CF fixture wire may be used where the temperature does not exceed 90° C., types RFH–2 and FFH–2 fixture wire may be used where the temperature does not exceed 75° C., and types TF, TFF, RF–2, and FF–2 fixture wire may be used where the temperature does not exceed 60° C.

111.60–5(h) *Fixture wire, voltage limitation.* Fixture wire shall not be used for applications exceeding 300 volts.

111.60–5(i) *Fixture wire, stranded.* Fixture wire shall be of the stranded type.

111.60–5(j) *Hook-up wire, application.* Hook-up wire for use within the components of alarm panels, IC equipment, and electronic control equipment shall be in accordance with Section 113.05–10 of this subchapter.

111.60–10 Wire and cable installation

111.60–10(a) *Propulsion cables.*

111.60–10(a)(1) *Splices and terminals.* Propulsion cables are to have no splices or joints except terminal joints and all cable terminals are to be effectively sealed against the admission of moisture or air; similar precautions should be taken during installation by sealing all cable ends until the terminals are permanently attached. Cable supports are to be strong enough to withstand short-circuited conditions; they are not to be spaced more than 36 inches apart and are to be arranged to prevent chafing of the cable.

TABLE 111.60–5(c)—*Maximum current-carrying capacities in amperes*[1][2]

	Portable cord				Fixture wire	
Size AWG	Rubber types C, E, EO, K, P, P–2, PD, PW, PW–2 Thermoplastic type ET	Rubber types S, SO, SJ, SJO Thermoplastic types ST, SJT	Types AFS, AFSJ, HC, HPD, HS, HSJ	Type AVPD	Rubber types RF–2, FF–2, RFH–2, FFH–2	Thermoplastic types TF, TFF Cotton type CF Asbestos type AF Silicone rubber type SF–2 SFF–2
18	5	7	10	17	5	6
16	7	10	15	22	7	8
14	15	15	20	28	-------	17
12	20	20	30	36	-------	--------
10	25	25	35	47	-------	--------
8	35	-------	------	------	-------	--------
6	45	-------	------	------	-------	--------
4	60	-------	------	------	-------	--------
2	80	-------	------	------	-------	--------

[1] If the number of current-carrying conductors in a cord exceeds three, the allowable current-carrying capacity of each conductor shall be reduced to 80 percent of the values in the table.

[2] In no case shall conductors be associated together in such a way with respect to the kind of circuit, the wiring method employed, or the number of conductors, that the limiting temperature of the conductors will be exceeded.

111.60–10(a)(2) *Single-conductor alternating-current cables.* Single-conductor alternating-current cables are to be supported on nonfragile insulators and the protective metal covering of each run of cable should be grounded at the middle only. Closed magnetic circuits around individual cables are not permitted and magnetic materials between cables of a group should be avoided. In order to minimize harmful inductive effect, cables in groups of considerable length should be transposed.

111.60–10(a)(3) *Multiconductor alternating-current cables.* Multiconductor alternating-current cables are to be mounted on approved supports and the lead sheath grounded at several points.

111.60–10(a)(4) *Deck and bulkhead penetrations.* Deck and bulkhead penetration shall comply with the requirements of Subparagraph (b)(4) of this Section.

111.60–10(b) *Ship's service cables.*

111.60–10(b)(1) *Cable joints and sealing.* The cable ends of all feeders and power branch circuits to vital auxiliaries are to be effectively sealed against the admission of moisture by methods such as taping in combination with insulating compound or, in the case of type MI, by fittings designed for that purpose.

111.60–10(b)(2) *Cable supports and radii of bends.* Where cables are run in groups they shall be supported in metal hangers arranged as far as practicable to permit painting of the surrounding structure without undue disturbance to the installation. Single cable runs may be supported by metal clips screwed directly to deck or bulkhead except on watertight bulkheads. Cables grouped in a single hanger shall be limited to two banks. Supports shall be spaced no more than 18 inches apart where vertical and 14 inches where horizontal. Cables shall be strapped in position at every hanger on vertical runs and at not less than every fourth hanger on horizontal runs, except that at turns of horizontal runs the cable shall be strapped at each hanger. Cables running transversely to and supported by clips or straps on the under side of beams shall be run on backing plates, cable racks, or the equivalent. Metal supports shall be designed to secure cable without damage to insulation or armor and shall be so arranged that the cables will bear over a length of at least one-half inch. Leaded and armored cables shall not be bent to a smaller radius than 8 cable diameters; other cables may be bent to a 6-cable diameter radius.

111.60–10(b)(3) *Alternating - current cable installations.* In order to avoid overheating by induction, all phase wires should be contained within the same armor by use of multiple conductor cables. Single-conductor cables may be used, however, where carrying negligible currents or where there are no closed magnetic circuits around the individual cables.

111.60–10(b)(4) *Deck and bulkhead penetrations.* Where cables pass through watertight decks or bulkheads, a watertight stuffing tube shall be employed. Where cables pass through nonwatertight bulkheads, beams, or similar structural parts where the bearing surface is less than one-fourth inch, the holes shall be fitted with bushings having rounded edges and a bearing surface for the cable of at least one-fourth inch in length. Where cables pass through nonwatertight bulkheads, deck beams, or similar structural parts where the bearing surface is one-fourth inch or greater in length, all burrs shall be removed in way of the hole and sharp edges shall be eliminated. Where cables pierce main vertical zone bulkheads, arrangements shall be made to ensure that the fire-resistance of the bulkheads is not impaired.

111.60–10(b)(5) *Grounding of cable metallic covering.* Each metallic-sheathed cable and each armored cable are to have the metallic covering electrically and mechanically continuous and grounded to the metal hull at each end of the run, except that final subcircuits may be grounded at the supply end only.

111.60–10(b)(6) *Mechanical protection.* All cables in bunkers and where particularly liable to damage such as locations in way of cargo ports, hatches, tank tops, and where passing through decks, shall be protected by removable metal coverings, angle irons, pipe or other equivalent means. All such metallic coverings are to be electrically continuous and grounded to the metal hull. Horizontal pipes or the equivalent used for cable protection should be provided with drainage holes, and, where they are carried through decks or bulkheads, arrangements should be made to insure the integrity of the water- or gas-tightness of the structure.

111.60–10(b)(7) *Generator cables.* Generator cables are not to be installed in the bilges.

★111.60–10(b)(8) *Feeder and branch circuit cables.* Cable of every description shall be located with a view to avoiding, as far as practicable, spaces where excessive heat and gases may be encountered, as well as spaces where they may be exposed to damage, such as exposed sides of deckhouses. Electrical conductors shall not enter oil tanks except as permitted by Section 111.65–3 and Section 38.15–15 of Subchapter D (Tank Vessels) of this chapter. Conductors shall avoid cofferdams adjacent to and extending below the tops of oil tanks except as permitted by Sections 111.60–40, 111.65–3, and 111.70–10.

111.60–10(b)(9) *Cables behind paneling.* Cables may be installed behind paneling provided all connections are readily accessible and the location of concealed connection boxes is indicated.

111.60–10(b)(10) *Cables behind sheathing.* Cables may be installed behind sheathing but they must not be installed behind nor imbedded in structural insulation; they should pass through such insulation at right angles and should be protected by continuous pipe with a stuffing tube at one end. For deck penetrations this stuffing tube should be at the upper end of the pipe and for bulkhead penetrations it should be on the uninsulated side of the bulkhead. For refrigerated space insulation, the pipe should be of a phenolic or similar heat insulating material joined to the bulkhead stuffing tube or a section of such material should be inserted between the bulkhead stuffing tube and the metallic pipe.

111.60–10(b)(11) *Bell wire.* Bell wire may be run in tubing or molding or the equivalent. All splices are to be made at outlets or connection boxes.

111.60–10(b)(12) *Lightning ground conductor.* Lightning ground conductor should be fitted to each wooden mast or topmast. They need not be fitted to steel masts.

111.60–15 General requirements for wiring methods

111.60–15(a) *Feeder and branch continuity.* Each feeder and each branch circuit cable supplying a single energy consuming appliance, shall be continuous throughout their lengths, except that a cable of large size or exceptional length may be spliced in a suitable junction box to effect greater ease of installation and except for cables that may be extended as permitted by paragraph (f) of this section.

111.60–15(b) *Boxes at outlets.* An outlet box shall be installed at each outlet, switch, receptacle, or junction point. In the complete installation, each outlet or junction box shall be provided with a cover unless a fixture canopy, switch cover, receptacle cover, etc., is used.

111.60–15(c) *Cables entering boxes.* Cables entering boxes or fittings shall be protected from abrasion, and shall conform to the requirements of this paragraph.

111.60–15(c)(1) Opening through which conductors enter shall be adequately closed.

111.60–15(c)(2) The cable armor shall be secured to the box or fitting.

111.60–15(c)(3) In damp or wet locations, the cable entrance shall be made watertight by means of a terminal or stuffing tube, except that cables entering the bottom of drip-proof enclosures need not be made watertight.

111.60–15(d) *Splices and taps.*

111.60–15(d)(1) Conductors shall be so spliced or joined as to be mechanically and electrically secure without solder and, unless an approved splicing device is used, shall then be either soldered with a fusible metal or alloy, or brazed or welded. All splices and joints shall be covered with an insulation equivalent to that on the original conductor.

111.60–15(d)(2) If not subjected to a temperature higher than 75° C, a splice or joint shall be covered with rubber or thermoplastic tape secured in place by an outer winding of friction tape, or with a standard combination tape or as specified in Subparagraph (3) or (4) of this paragraph.

111.60–15(d)(3) If subjected to a temperature higher than 75° C. but not higher than 90° C., a splice or joint shall be covered with asbestos cord or tape secured in place by an outer winding of friction tape or bonded with water-glass (sodium silicate) or as specified in Subparagraph (4) of this paragraph.

111.60–15(d)(4) If subjected to a temperature higher than 90° C., a splice or joint shall be covered with asbestos cord or tape bonded with water-glass.

111.60–15(d)(5) Other methods of insulating splices and taps, such as wrapping with layers of varnished-cambric tape followed by painting with insulating varnish, when properly done, are also acceptable.

111.60–15(d)(6) Rubber and thermoplastic insulating tapes shall be of a type listed as approved by Underwriters' Laboratories, Inc.

111.60–15(e) *Connections to terminals.*

111.60–15(e)(1) Connection of conductors to terminal parts shall insure a thoroughly good connection without damaging the conductors and shall be made by means of pressure connectors, solder lugs, or splices to flexible leads either soldered, brazed, or welded, except that No. 10 or smaller conductors may be connected by means of clamps or screws with terminal plates having upturned lugs. Terminals for more than one conductor shall be of a type approved for that purpose.

111.60–15(e)(2) Connectors, or lugs of the setscrew type shall not be used with stranded conductors smaller than No. 14 AWG unless provided with a nonrotating follower traveling with the setscrew and making pressure contact with the conductor.

111.60–15(e)(3) Pressure-type wire connectors, fixture splicing connectors, and lugs shall conform to the requirements of Underwriters' Laboratories, Inc., Standard for Wire Connectors and Soldering Lugs, and shall be so listed by Underwriters' Laboratories, Inc.

111.60–15(e)(4) Terminal blocks shall employ terminal screws not smaller than 6–32, and spacings not less than that shown in Table 111.60–15(e)(4).

111.60–15(f) *Extending feeder and branch circuit cables.* Existing feeder and branch circuit cables may be extended for vessels receiving major alterations provided the requirements of this paragraph are met.

111.60–15(f)(1) The cables shall be spliced in suitable junction boxes.

111.60–15(f)(2) Each vital and emergency circuit shall be spliced in individual, suitable junction boxes.

TABLE 111.60–15(e)(4)—*Terminal block spacings*

Voltage involved	Minimum spacings in inches between parts of opposite polarity and between live parts and ground	
	Through air	Over surface
0–250	¼	⅜
251–600	⅜	⅜

111.60–15(f)(3) Circuits of different voltages shall not be extended by means of a common cable or junction box.

111.60–15(f)(4) Existing cables of less than 25 feet in length shall not be extended but shall be replaced.

111.60–20 Outlet boxes

111.60–20(a) *General.* The requirements of this section are applicable to outlet boxes for use with lighting fixtures, wiring devices, and the like, including separately installed connection and junction boxes, having a volume of not more than 100 cubic inches. Boxes of large size will require special consideration.

111.60–20(b) *Size.* Outlet boxes shall have an internal depth of at least 1½ inches, except that when an outlet box is incorporated in a fixture the depth may be decreased to not less than 1 inch provided the outlet box volume is not less than 20 cubic inches. The free space within an outlet box for each conductor, not counting fixture wires, shall be not less than that given in Table 111.60–20(b). Table 111.60–20(b) applies where no fitting or devices, such as cable clamps, hickeys, switches or receptacles are contained in the box. Where one or more such devices are contained in the box, each such device shall count as one conductor. Each conductor terminated in the box is counted as one conductor.

TABLE 111.60–20(b)—*Outlet box size*

AWG size of conductor, No.—	Free space in cubic inches for each conductor within box
14	2. 0
12	2. 25
10	2. 5
8	3. 0

111.60–20(c) *Degree of enclosure.* Outlet boxes for use in damp or wet locations shall be of watertight construction.

111.60–20(d) *Mounting and grounding.* Outlet boxes shall be securely fastened in place and grounded to the hull of the vessel. Outlet boxes of watertight construction shall have external mounting feet or lugs.

111.60–20(e) *Penetration of walls.* Holes in the walls of watertight outlet boxes for the purpose of providing means for the attachment of parts on the exterior or interior thereof, or for securing the cover and the like, shall not penetrate the total thickness of the box wall.

111.60–20(f) *Construction.* The construction of outlet boxes shall conform with the requirements of Underwriters' Laboratories, Inc., Standard for Outlet Boxes and Fittings, except that sheet steel outlet boxes shall not be installed in corrosive locations.

111.60–25 Switches and circuit breakers

111.60–25(a) *General requirements.*

111.60–25(a)(1) *Grounded conductor.* No switch or circuit breaker shall disconnect the grounded conductor of a circuit unless the switch or circuit breaker simultaneously disconnects the ungrounded conductor or conductors.

111.60–25(a)(2) *Three-way and four-way switches.* Three-way and four-way switches shall be so wired that all switching is done only in the ungrounded circuit conductor.

111.60–25(a)(3) *Enclosures.* Switches and circuit breakers, except pendant and surface type snap switches and knife switches mounted on an open-face switchboard or panelboard, shall be of the externally operative type enclosed in metal boxes or cabinets.

111.60–25(a)(4) *Position of knife switches.* Single-throw knife switches shall be so placed that gravity will not tend to close them. Double-throw knife switches may be mounted so that the throw will be either vertical or horizontal as preferred, but if the throw be vertical a locking device shall be provided which will insure the blade remaining in the open position when so set.

111.60–25(a)(5) *Circuit connections.* Knife switches, unless of the double-throw type, shall be so connected that the blades are dead when the switch is in the open position. Circuits shall be connected to the fuse end of switches and to the coil end of circuit breakers, except that generators or incoming feeders may be connected to either end of circuit breakers.

111.60–25(a)(6) *Accessibility and grouping.* Switches and circuit breakers, so far as practicable, shall be readily accessible and shall be grouped.

111.60–25(a)(7) *Circuit breakers as switches.* A circuit breaker operable directly by applying the hand to a lever or handle may serve as a switch provided it has the number of poles required for such switch.

111.60–25(a)(8) *Grounding of enclosures.* Enclosures for switches or circuit breakers shall be grounded.

111.60–25(a)(9) *Knife switches.* Knife switches rated for more than 1,200 amperes at 250 volts or less, and for more than 600 amperes at 251 to 600 volts shall be used only as isolating switches and shall not be opened under load. To interrupt currents greater than 1,200 amperes at 250 volts or less, or 600 amperes at 251 to 600 volts, a circuit breaker or a switch of special design approved for such purpose shall be used. Knife switches of lower rating may be used as general-use switches and may be opened under load. Motor-circuit switches may be of the knife-switch type. (See Paragraphs 111.45–30 (d), (e) and (f).)

111.60–25(a)(10) *Rating of snap switches.* Snap switches shall be rated as described in this subparagraph depending upon the load controlled.

111.60–25 (a) (10) (i) *Noninductive loads.* For noninductive loads other than tungsten-filament lamps, switches shall have an ampere rating not less than the ampere rating of the load.

111.60–25(a)(10)(ii) *Tungsten-filament lamp loads.* For tungsten-filament lamp loads, and for combined tungsten-filament and noninductive loads, switches shall have a "T" rating not less than the ampere rating of the load.

111.60–25(a)(10)(iii) *Inductive loads.* Switches controlling inductive loads shall have an ampere rating twice the ampere rating of the load unless they are of a type approved as part of an assembly or for the purpose employed.

111.60–25(a)(10)(iv) *Motor-circuit switches.* For switches controlling motors see Section 111.45–30 and Subparagraph (b)(4) of this Section.

111.60–25(b) *Detail requirements.*

111.60–25(b)(1) *Circuit breakers.* Circuit breakers shall comply with Paragraph 111.55–15(e).

111.60–25(b)(2) *Knife switches.* The construction of knife switches shall conform to the requirements of Underwriters' Laboratories, Inc., Standard for Knife Switches.

111.60–25(b)(3) *Snap switches.* The construction of snap switches shall conform with the requirements of Underwriters' Laboratories, Inc., Standard for Snap Switches and the switches shall be so labeled. The switches, when installed in an outlet box and wired shall have minimum spacing between live parts and ground of one-fourth inch, through air or over surfaces for potentials of 250 volts or less.

111.60–25(b)(4) *Enclosed switches.* Enclosed switches shall conform to the requirements of Underwriters' Laboratories, Inc., Standard for Enclosed Switches, except that sheet metal enclosures shall not be employed for use in corrosive locations unless one of the conditions covered in this subparagraph is complied with.

111.60–25(b)(4)(i) The enclosure is fabricated of corrosion-resistant material.

111.60–25(b)(4)(ii) The enclosure is fabricated of sheet steel not less than one-eighth inch in thickness and hot dip galvanized after fabrication.

111.60–25(b)(4)(iii) The enclosure is fabricated of sheet steel not less than three-sixteenths inch in thickness and given a corrosion-resistant finish in accordance with Section 110.15–40 of this Subchapter.

111.60–26 Shore connection boxes

111.60–26(a) Shore connection boxes shall be of ample size to accommodate the connections of the portable and fixed cables, and shall be of watertight construction when installed in damp or wet locations.

111.60–26(b) Shore connection boxes for installation in corrosive locations shall not be constructed of sheet metal unless the conditions of Subdivision 111.60–25(b)(4) (i), (ii), or (iii) are met.

111.60–26(c) The minimum spacing between live parts and between live parts and ground in shore connection boxes shall meet the requirements of Table 111.35–5(d). Means other than friction between parts shall be provided to prevent cable lugs from rotating.

111.60–26(d) Shore connection boxes shall be arranged for bottom entrance of portable cable and shall provide a protected enclosure while in use.

111.60–30 Receptacle outlets and attachment plugs

★ 111.60–30(a) Receptacle outlets and attachment plugs for the attachment of portable lamps, tools, and similar apparatus supplied as ship's equipment and operating at 100 volts or more, shall provide a grounding pole and a grounding conductor in the portable cord to ground the dead metal parts of the portable apparatus. For portable devices made entirely of nonconducting material or so constructed that dead metal parts will not become energized under any conditions, the grounding conductor in the portable cord and the grounding pole of the attachment plug need not be furnished. Portable apparatus shall be deemed to be any apparatus served by means of a flexible extension cord, whether the apparatus is permanently mounted or not.

111.60–30(b) Receptacle outlets provided for the convenience of, and located in quarters for passengers or crew for connecting portable appliances operating at 100 volts or more, shall provide a grounding pole.[1]

111.60–30(c) Receptacle outlets of the type providing a grounding pole shall be of a distinctive design that will not permit the dead metal parts of portable apparatus to be connected to a live conductor.

111.60–30(d) Receptacle outlets for use in damp or wet locations shall be so designed that, when the plug is in place, the plug will be held in positive contact and will establish and maintain a watertight integrity of the enclosure.

111.60–30(e) Receptacle outlets for use in damp or wet locations shall be so designed that, when the plug is not in place, the plug opening may be closed to establish and maintain a watertight integrity of the enclosure. Where threaded caps are used for this purpose, the cap shall be mechanically fastened to the cover or enclosure by a strong link or hinged strap.

111.60–30(f) Receptacle outlets for use in locations exposed to the weather shall be so designed that with the plug opening uncovered, water will not collect in the interior of the box.

111.60–30(g) Receptacle outlets for use in locations where accessible to other than qualified persons shall, with the plug opening uncovered, present no live parts. Any screw, rivet, contact, or the like which is accessible and in electrical connection with any live-metal part shall be located in a hole not more than $\frac{9}{32}$-inch in diameter and recessed not less than $\frac{3}{16}$-inch in the clear.

★111.60–30(h) When it is necessary to transmit current in one direction between two receptacle outlets by means of a portable cable with a plug on each end (such as a battery charging lead between a receptacle outlet on a ship and a receptacle outlet in a lifeboat), the plug which may be energized when not inserted in the receptacle outlet, shall be of the female type. When receptacle outlets may be used as a source of power as well as to receive power (such as the receptacles on barges that may have to supply power to adjoining barges in some make-ups and receive power from the towboat or adjoining barge in other make-ups) the receptacles shall be of the male, reverse service type. Plugs of associated portable cable shall be of the female type and shall be provided at both ends of the portable lead. The female type plug specified in this paragraph shall comply with the requirements of paragraph (g) of this section.

111.60–30(i) A receptacle outlet installed on a lifeboat for the purpose of connecting it to the ship's electrical system shall be of a type that will permit the plug to pull free should the lifeboat be lowered.

111.60–30(j) Where receptacle outlets on a ship are connected to different potentials, or to different types of potentials, receptacle outlet types shall be selected so that a portable device cannot be plugged into a receptacle outlet of an unsuitable potential.

111.60–30(k) Receptacle outlets and plugs for use in damp or wet locations shall be constructed of corrosion-resistant material(s), or of a material(s) with a corrosion-resistant finish(es), except that receptacle outlets and plugs for use in corrosive locations shall be constructed of corrosion-resistant material(s).

111.60–30(l) Receptacle outlets and plugs when installed and wired shall have a minimum spacing between live parts and ground of $\frac{1}{4}$-inch through air or over surface for potentials of 250 volts or less.

111.60–30(m) Interior units of receptacle outlets and plugs shall conform to the requirements of Underwriters' Laboratories, Inc., Standard for Attachment Plugs and Receptacles.

★111.60–35 Lighting fixtures

111.60–35(a) *General Requirements.*

111.60–35(a)(1) Construction details shall be in accordance with Underwriters' Laboratories, Inc., Standard for Marine Type Electric Lighting Fixtures Subject 595.

111.60–35(a)(2) Open arc lamps shall not be used for applications other than for searchlights and for motion picture projectors.

111.60–35(a)(3) Fixture globes shall be protected by guards except in living quarters, wheelhouse, gyro room, radio room, galley, and similar spaces where not subject to mechanical damage. The lamps of incandescent lighting fixtures located in propulsion machinery spaces, boiler spaces, and other spaces where flammable liquids are piped under pressure shall be protected by globes, or by similar means, that will prevent a liquid from impinging directly on the lamp bulb when sprayed on the fixture from any direction.

111.60–35(a)(4) Fixtures shall be of such construction, or so installed, that the conductors in outlet boxes will not be subjected to temperatures greater than that for which the conductors are approved (75° C. for rubber insulated conductors, 85° C. for varnished-cambric insulated and mineral-insulated conductors, 95° C. for asbestos-varnished-cambric insulated conductors, and 105° C. for MIL–C–2194 type SGA cable). For the purpose of this section, an ambient temperature of 25° C. will be assumed for passenger and crew quarters, public spaces, cargo spaces, and open deck areas, an ambient temperature of 40° C. will be assumed for auxiliary machinery and work spaces, and an ambient temperature of 50° C. will be assumed for the engine and boiler rooms.

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[1] Applicable to vessels contracted for on or after Jan. 1, 1964 Vessels contracted for before Jan. 1, 1964, need not provide a type with grounding pole if operating at 125 volts or less

111.60–35(a)(5) Fixtures shall be so constructed, or installed, or equipped with shades and/or guards that combustible material will not be subjected to temperatures in excess of 90° C.

111.60–35(a)(6) Fixtures shall not be used as connection boxes for circuits other than the branch circuit supplying the fixture except that two or more circuits may supply the fixture when:

111.60–35(a)(6)(i) One or more lamps of a multilamp fixture are supplied from an emergency lighting circuit; or

111.60–35(a)(6)(ii) When the number of lamps of a fixture exceeds the capacity of a single circuit. When more than one circuit is employed in a fixture, the circuits shall be as widely separated as possible and the different circuits clearly identified at terminal points. Also see Subparagraph 111.50–20(c)(5).

111.60–35(a)(7) For wiring of explosionproof equipment see Section 111.60–40.

111.60–35(b) *Lighting fixture installations.*

111.60–35(b)(1) Fixtures installed in locations exposed to the weather and in other locations occasionally exposed to splashing water shall be of watertight construction. Fixtures installed in other wet or damp locations shall be of at least dripproof construction as installed.

111.60.35(b)(2) Any combustible bulkhead or ceiling finish exposed between the edge of a fixture canopy or pan and the outlet box shall be covered with noncombustible material.

111.60–35(b)(3) In a completed installation, each outlet box shall be provided with a cover unless it is covered by means of a fixture canopy, lampholder, or similar device.

111.60–35(b)(4) Fixtures, lampholders, and receptacle outlets shall be securely supported. Fixtures shall not be supported by the screw shell of a lampholder.

111.60–35(b)(5) Pendent fixtures shall be suspended by, and supplied through threaded rigid conduit stems.

111.60–35(b)(6) Table lamps, desk lamps, floor lamps, and similar equipment shall be secured in place to prevent displacement by the roll or pitch of the vessel.

111.60–35(c) *Grounding of lighting equipment.*

111.60–35(c)(1) Lighting equipment (including fixtures) shall be grounded.

111.60–35(c)(2) Equipment shall be considered as grounded when mechanically connected in a permanent and effective manner to the metal structure of the ship, the armor of armored cable, or a grounding connector.

★111.60–40 Wiring methods and materials for hazardous locations

111.60–40(a) *General.*

111.60–40(a) *General.* (1) The provisions of this section apply to locations in which equipment and wiring are subjected to the conditions indicated by the classifications covered by Subparagraphs (8) through (10) of this paragraph. It is necessary that each compartment or area containing electrical equipment be considered individually in order to determine its hazard classification. Except as modified by this section, all other applicable rules contained in this subchapter shall apply to electrical equipment and wiring installed in hazardous locations.

111.60–40(a)(2) The term "explosionproof" as used in this section shall mean enclosed in a case which is capable of withstanding an explosion of a specified gas or vapor which may occur within it, and of preventing the ignition of the specified gas or vapor surrounding the enclosure by sparks, flashes or explosions of the gas or vapor within.

111.60–40(a)(3)(i) The term "intrinsically safe" when used with instruments and equipment or wiring shall mean such instruments and equipment or wiring that is incapable of releasing sufficient electrical or thermal energy under normal or abnormal conditions to cause ignition of a specific hazardous atmospheric mixture in its most easily ignited concentration.

111.60–40 (a) (3) (ii) Intrinsically safe instruments and equipment or wiring may be installed in any hazardous area for which it has been approved by the Commandant. It may be used in lieu of explosionproof equipment. Detailed requirements are contained in Section 111.65–3.

111.60–40(a)(4) Through the exercise of ingenuity in the layout of electrical installations for hazardous locations, it is frequently possible to locate much of the equipment in less hazardous or in nonhazardous areas and thus reduce the amount of special equipment required. The amount of electrical equipment or wiring in hazardous locations shall be minimized.

111.60–40(a)(5) The intent of this section is to require a form of construction of equipment, and of installation that will insure safe performance under conditions of proper use and maintenance. It is necessary, therefore, that more than ordinary care be exercised with regard to the installation and maintenance of equipment and wiring in hazardous areas.

111.60–40(a)(6) Explosionproof switches and switches controlling explosionproof equipment shall have a pole for each circuit conductor.

111.60–40(a)(7) The explosive characteristics of various atmospheric mixtures of hazardous gases, vapors, and dusts depend on the specific hazardous material involved. It is necessary, therefore, that equipment be designed not only for the class of location but also for the specific gas, vapor or dust that will be present. For the purpose of approval, the following atmospheric mixtures have been grouped on the basis of their explosive characteristics:

Group A, Atmospheres containing acetylene;

Group B, Atmospheres containing hydrogen, or gases or vapors of equivalent hazard, such as manufactured gas;

Group C, Atmospheres containing ethyl ether vapor;

Group D, Atmospheres containing gasoline, petroleum, naphtha, alcohols, acetone, lacquer solvent vapors, and natural gas;

Group E, Atmospheres containing metal dust;

Group F, Atmospheres containing carbon black, coal or coke dust; and

Group G, Atmospheres containing grain dust.

111.60–40(a)(8) Class I locations are those in which flammable gases or vapors are or may be present in the air in quantities sufficient to produce explosive or ignitible mixtures. Class I locations shall include the following.

111.60–40(a)(8)(i) Class I, Division 1, Locations: (*a*) in which hazardous concentrations of flammable gases or vapors exist continuously, intermittently, or periodically under normal operating conditions; (*b*) in which hazardous concentrations of such gases or vapors may exist frequently because of repair or maintenance operations or because of leakage; or (*c*) in which breakdown or faulty operation of equipment or processes which may release hazardous concentrations of flammable gases or vapors, might also cause simultaneous failure of electrical equipment. This classification would usually include locations such as cargo tanks, cargo pumprooms, cofferdam areas, and in some cases open deck areas, storage and mixing rooms for paint and allied products, storage rooms for oil, oil lamps and the like, battery rooms, and hospital operating rooms in which combustible anesthetics may be administered.

111.60–40(a)(8)(ii) Class I, Division 2, Locations: (*a*) in which flammable volatile liquids or flammable gases are handled, processed or used, but in which the hazardous liquids, vapors, or gases will normally be confined within closed containers or closed systems from which they can escape only in case of abnormal operation of equipment; (*b*) in which hazardous concentrations of gases or vapors are normally prevented by positive mechanical ventilation, but which might become hazardous through failure or abnormal operation of the ventilating equipment; or (*c*) which are adjacent to Class I, Division 1 locations, and to which hazardous concentrations of gases or vapors might occasionally be communicated unless such communication is prevented by adequate positive-pressure ventilation from a source of clean air, and effective safeguards against ventilation failure are provided. This classification would usually include locations where flammable volatile liquids or flammable gases or vapors are used, but which in the judgment of the Commandant would become hazardous only in case of an accident or of some unusual operating conditions. The quantity of hazardous material that might escape in case of accident, the adequacy of ventilating equipment, and the total area involved shall receive consideration in determining the classification and extent of each hazardous area.

111.60–40(a)(8)(iii) Special limitations and requirements for electrical installations in hazardous locations on tank vessels are contained in Subpart 111.70 of this part.

111.60–40(a)(9) Class II locations are those in which combustible dust is or may be in the air continuously, intermittently, or periodically under normal conditions, in quantities sufficient to produce explosive or ignitible mixtures.

111.60–40(a)(9)(i) This classification would usually include the working areas handling bulk grain and similar products, coal pulverizing plants (except where the pulverizing equipment is essentially dusttight), and the like.

111.60–40(a)(10) Class III locations are those in which easily ignitible fibers or materials producing combustible flyings are handled or used.

111.60–40(a)(10)(i) Easily ignitible fibers and combustible flyings will include rayon, cotton (including cotton linters and cotton waste), sisal or henequen, istle, jute, hemp, tow, cocoa fiber, oakum, baled waste, kapok, Spanish moss, excelsior, sawdust, and other materials of similar nature.

111.60–40(a)(10)(ii) Class III locations will usually include areas where the above products are handled in bulk, and in carpenter shops and similar locations.

111.60–40(a)(11) Where it is specified in this section that equipment shall be approved for Class I or Class II locations, approval by an independent testing laboratory is required. This approval shall be based on the tests outlined in the Underwriters' Laboratories, Inc. Standards for Industrial Control Equipment for Use in Hazardous Locations, Subject 698. Equipment that bears the Underwriters' Laboratories, Inc. label is acceptable for the class of hazardous locations indicated on the label.

111.60–40(b) *Electrical installations in Class I, Division 1, Groups A, B, C, and D hazardous locations.*

111.60–40(b)(1) *Meters, instruments and relays.* Meters, instruments and relays, including kilowatt-hour meters, instrument transformers and resistors, rectifiers and thermionic tubes, shall be provided with explosionproof enclosures approved for Class I locations.

111.60–40(b)(2) *Switches, circuit breakers, motor controllers and fuses.* Switches, circuit breakers, motor controllers and fuses, including pushbuttons, relays and similar devices, shall be provided with enclosures, and the enclosures in each case together with the enclosed equipment, shall be approved as a complete assembly for use in Class I locations.

111.60–40(b)(3) *Control transformers and resistors.* Transformers, impedance coils and resistors used as, or in conjunction with, control equipment for motors, generators and appliances, together with any switching mechanism associated with them, shall be provided with explosionproof enclosures approved for Class I locations.

111.60–40(b)(4) *Motors and generators.* Motors, generators and other rotating electrical machinery shall be of enclosed explosionproof type approved for Class I locations.

111.60–40(b)(5) *Lighting fixtures.* Each lighting fixture shall be approved as a complete assembly for Class I locations, and shall be clearly marked to indicate the maximum wattage of lamps for which it is approved. Fixtures intended for portable use shall be specifically approved as a complete assembly for that use.

111.60–40(b)(5)(i) *Mechanical injury.* Each fixture shall be protected against mechanical injury by a suitable guard. Pendent fixtures having rigid conduit stems longer than 12 inches shall have permanent and effective bracing against lateral displacement.

111.60–40(b)(5)(ii) *Supports.* Boxes, box assemblies, or fittings used for the support of lighting fixtures shall be approved for the purpose and for Class I locations.

111.60–40(b)(6) *Appliances, fixed and portable.* Appliances, including electrically heated and motor-driven appliances, shall be approved for Class I locations.

111.60–40(b)(7) *Flexible cords.* A flexible cord may be used only for connections between a portable lamp or a portable appliance and the fixed portion of its supply circuit, and, where used, shall be of a type approved for extra hard usage; shall contain, in addition to the conductors of the circuit, a grounding conductor, shall be connected to terminals or to supply conductors in an approved manner, shall be supported by clamps or by other suitable means in such a manner that there will be no tension on the terminal connections, and shall be provided with suitable seals where the flexible cord enters boxes, fittings, or enclosures of the explosionproof type.

111.60–40(b)(7)(i) Where flexible cords may be exposed to liquids having a deleterious effect on rubber, they shall be of a type approved for use under such conditions.

111.60–40(b)(8) *Receptacle and attachment plugs.* Receptacles and attachment plugs shall be of the polarized type providing for connection to the grounding conductor of the flexible cord and shall be approved for Class I locations.

111.60–40(b)(9) *Signal, alarm, remote-control and communication systems.* Signal, alarm, remote-control and communication systems, irrespective of voltage, shall be approved for Class I locations.

111.60–40(b)(10) *Wiring methods.*

111.60–40(b)(10)(i) Electric cables shall be leaded and armored, or impervious sheathed and armored, or mineral-insulated metal sheathed.

111.60–40(b)(10)(ii) The cable entrance to each explosionproof device shall be sealed to prevent the passage of gases, vapors, or flame from within the explosionproof enclosure.

111.60–40(b)(10)(iii) The seal fitting shall be located as close as practicable to, but in no case more than 18 inches from, the enclosure, and shall be connected thereto by means of a short length of rigid metal conduit with threaded explosionproof joints each having at least 5 full threads engaged. Type MI cables, however, shall enter enclosures directly through explosionproof fittings especially approved for Class I locations.

111.60–40(b)(10)(iv) Except for type MI cables, all cable covering except the individual conductor insulation shall be removed in way of the seal fitting, and the seal fitting filled with a sealing compound.

111.60–40(b)(10)(v) The sealing compound shall be approved for the purpose, shall not be effected by the surrounding atmosphere or liquids, and shall not have a melting point of less than 93 degrees C.

111.60–40(b)(10)(vi) In the completed seal, the minimum thickness of the sealing compound shall be not less than the trade size of the conduit, and in no case less than 5/8 inch.

111.60–40(b)(10)(vii) Splices and taps shall not be located in the seal fitting, nor shall other fittings in which splices or taps are made be filled with compound.

111.60–40(c) *Electrical installations in Class I, Division 2, Groups A, B, C, and D hazardous locations.*

111.60–40(c)(1) *Equipment with sliding contacts or contacts for making or breaking current, relays, switches, circuit breakers, motor controllers, and fuses.* All switching and current interrupting mechanisms shall be provided with explosionproof enclosures approved for Class I locations, unless provided with nonexplosionproof enclosures otherwise suited to the location where installed with features described in subparagraph (2) of this paragraph, and interruption of current occurs in a chamber hermetically sealed against the entrance of gases and vapors or the current interrupting contacts are oil immersed and the device is approved for the location.

111.60–40(c)(2) *Meters, instruments, transformers, resistors, thermionic tubes, solenoids, and impedance coils.* Equipment which does not incorporate sliding or make and break contacts shall be provided with explosionproof enclosures approved for Class I locations, unless provided with nonexplosionproof enclosures otherwise suited to the location where installed with vents adequate to permit prompt escape of any gases or vapors. The maximum operating temperature of any exposed surface shall not exceed 80 percent of the ignition temperature in degrees centigrade of the gas or vapor involved.

111.60–40(c)(3) *Motors and generators.* Motors, generators and other rotating electrical machinery in which are employed sliding contacts, centrifugal or other types of switching mechanism (including motor overcurrent devices), or integral resistance devices, either while starting or while running, shall be of enclosed explosionproof type approved for Class I locations. Non-explosionproof enclosed motors such as squirrel cage induction motors without brushes, switching mechanisms, etc., are permitted.

111.60–40(c)(4) *Lighting fixtures.* Each lighting fixture shall either be approved for Class I locations or shall be provided with globes and guards and, under normal operating conditions, the lamps shall not reach surface temperatures exceeding eighty percent (80%) of the ignition temperature in degrees Centigrade of the gas or vapor involved. Pendent fixtures shall be in accordance with paragraph (b)(5)(i) of this section.

111.60–40(c)(5) *Appliances, fixed and portable.* Motors, switches, circuit breakers and fuses shall conform to subparagraphs (1) through (3) of this paragraph. Electrically heated appliances shall be approved for Class I locations.

111.60–40(c)(6) *Flexible cords.* Flexible cords shall conform to paragraph (b)(7) of this section.

111.60–40(c)(7) *Receptacles and attachment plugs.* Receptacles and attachment plugs shall conform to paragraph (b)(8) of this section.

111.60–40(c)(8) *Wiring methods.* Explosionproof enclosures and equipment shall conform to subparagraph (b)(10) of this paragraph. Nonexplosionproof equipment and enclosures shall conform to Section 111.60–15.

111.60–40(d) *Electrical installations in Class II hazardous locations.*

111.60–40(d)(1) *Switches, circuit breakers, motor controllers, and fuses.* Switches, circuit breakers, motor controllers and fuses, including pushbuttons, relays and similar devices, which are intended to interrupt current in the normal performance of the function for which they are installed, or which are installed where dusts of an electrically conducting nature may be present, shall be provided with dusttight enclosures approved for Class II locations.

111.60–40(d)(1)(i) Disconnecting and isolating switches containing no fuses and not intended to interrupt current, and which are not installed where dust may be of an electrically conducting nature, shall be provided with tight metal enclosures which shall be equipped with close-fitting covers, or with other effective means to prevent the escape of sparks or burning material, and shall have no openings (such as holes for attachment screws) through which, after installation, sparks or burning material might escape, or through which exterior accumulations of dust or adjacent combustible material might be ignited.

111.60–40(d)(2) *Control transformers and resistors.* Transformers, impedance coils and resistors used as, or in conjunction with, control equipment for motors, generators and appliances, and any overcurrent devices or switching mechanisms associated with them, shall have dusttight enclosures approved for Class II locations.

111.60–40(d)(3) *Motors and generators.* Motors, generators and other rotating-electrical machinery shall be totally enclosed not ventilated, totally enclosed pipe-ventilated, or totally enclosed fan-cooled, and shall be approved for Class II locations.

111.60–40(d)(4) *Appliances, fixed and portable.* Appliances, fixed and portable, including electrically heated and motor-driven appliances, shall be approved for Class II locations.

111.60–40(d)(5) *Lighting fixtures.* Each lighting fixture, fixed or portable, shall be approved for Class II locations, and shall be clearly marked to indicate the maximum wattage of the lamp for which it is approved. Each fixture shall be protected against mechanical injury by a suitable guard. Pendent fixtures having rigid conduit stems longer than 12 inches shall have permanent and effective bracing against lateral displacement. Boxes, box assemblies, or fittings used for the support of lighting fixtures shall be approved for the purpose and for Class II locations.

111.60–40(d)(6) *Receptacles and attachment plugs.* Receptacles and attachment plugs shall be polarized type providing for connection to the grounding conductor of the flexible cord, and shall be approved for Class II locations.

111.60–40(d)(7) *Signal, alarm, remote-control, and communication systems.*

111.60–40(d)(7)(i) Switches, circuit breakers, relays, contactors, and fuses which may interrupt other than voice currents, and current-breaking contacts for bells, horns, howlers, sirens and other devices in which sparks or arcs may be produced shall be provided with dusttight enclosures approved for Class II locations.

111.60–40(d)(7)(ii) Resistors, transformers, and choke coils which may carry other than voice currents, and rectifiers, thermionic tubes, and other heat generating equipment or apparatus shall be provided with dusttight enclosures approved for Class II locations.

111.60–40(d)(8) *Wiring methods.*

111.60–40(d)(8)(i) *Fittings and boxes.* Fittings and boxes shall be provided with threaded bosses for terminal tubes, shall have close fitting covers, and shall have no openings (such as holes for attaching screws) through which sparks or burning material might escape. Fittings or boxes in which taps, joints or terminal connections are made, or which are used in locations where dusts are of an electrically conducting nature, shall be approved for Class II locations.

111.60–40(d)(8)(ii) *Electric cables.* Electric cables shall be leaded and armored, impervious sheathed and armored, or mineral-insulated metal sheathed. Cable entrances shall be made dusttight by terminal tubes or, in case of Type MI cable, by fittings designed for that purpose.

111.60–40(d)(8)(iii) *Flexible connections.* Where necessary to employ flexible connections, dusttight flexible connectors, flexible metal conduit, or flexible cord approved for extra hard usage and provided with bushed fittings shall be used, except that where dusts are of an electrically conducting nature, flexible metal conduit shall not be used, and flexible cords shall be provided with dust seals at both ends. Where flexible cords are subject to oil or other corrosive conditions, the conductors shall be of a type approved for the condition. An additional conductor for grounding shall be provided in the flexible cord.

111.60–40(e) *Electrical installations in Class III hazardous locations.*

111.60–40(e)(1) *Switches, circuit breakers, motor controllers, and fuses.* Switches, circuit breakers, motor controllers, and fuses, including pushbuttons, relays, and similar devices, shall be provided with tight metal enclosures which shall be equipped with close fitting covers, or with other effective means to prevent escape of sparks or burning material, and shall have no openings (such as holes for attachment screws) through which, after installation, sparks or burning material might escape, or through which exterior accummulations of fibers or flyings or adjacent combustible material might be ignited.

111.60–40(e)(2) *Control transformers and resistors.* Transformers, impedance coils and resistors used as, or in conjunction with, control equipment for motors, generators and appliances, shall conform to paragraph (d)(2) of this section.

111.60–40(e)(3) *Motors and generators.* Motors, generators, and other rotating electrical machinery shall be totally enclosed not ventilated, totally enclosed pipe-ventilated, or totally enclosed fan-cooled.

111.60–40(e)(4) *Appliances, fixed and portable.* Appliances, fixed and portable, shall conform to the requirements of this subparagraph.

111.60–40(e)(4)(i) *Heaters.* Electrically heated appliances shall be provided with dusttight enclosures, and shall be approved for Class III locations.

111.60–40(e)(4)(iii) *Motors.* Motors of motor-driven appliances shall conform to subparagraph (3) of this paragraph. Appliances which may be readily moved from one location to another shall conform to requirements for the most hazardous location.

111.60–40(e)(4)(iii) *Switches, circuit breakers, motor controllers and fuses.* Switches, circuit breakers, motor controllers and fuses shall conform to the requirements of paragraph (d)(1) of this section.

111.60–40(e)(5) *Lighting fixtures.* Lighting fixtures shall conform to the requirements of this subparagraph.

111.60–40(e)(5)(i) *Construction.* Each fixture shall be of dusttight type so designed that in the event of burnout of lamp or lampholder, no spark or hot metal can escape from the fixture. Unless each fixture is so constructed that it will not accept a lamp of larger wattage than that for which it is designed, it shall be clearly marked to indicate the maximum wattage of lamp that should be used.

111.60–40(e)(5)(ii) *Mechanical injury.* A fixture which may be exposed to mechanical injury shall be protected by a suitable guard.

111.60—40(e)(5)(iii) *Supports.* Boxes, box assemblies, or fittings used for the support of lighting fixtures shall be of a type approved for the purpose.

111.60–40(e)(5)(iv) *Portable lamps.* Portable lamps shall be dusttight and shall be protected with substantial guards. Lampholders shall be of unswitched type with no exposed metal parts. Unless the portable lamp is so constructed that it will not accept a lamp of larger wattage than that for which it is designed, it shall be clearly marked to indicate the maximum wattage of lamp that should be used.

111.60–40(e)(6) *Receptacles and attachment plugs.* Receptacles and attachment plugs shall conform to the requirements of paragraph (d)(6) of this section.

111.60–40(e)(7) *Signal, alarm, remote-control and communication systems.* Signal, alarm, remote-control and communication systems shall conform to the requirements of paragraph (d)(7) of this section.

111.60–40(e)(8) *Wiring methods.*

111.60–40(e)(8)(i) *Fittings and boxes.* Fittings and boxes in which taps, joints, or terminal connections are made shall be provided with close fitting covers, or other effective means to prevent the escape of sparks or burning material, and shall have no openings (such as holes for attaching screws) through which, after installation, sparks or burning material might escape, or through which exterior accumulations of fibers or flyings or adjacent combustible materials might be ignited.

111.60–40(e)(8)(ii) *Electric cables.* Electric cables shall conform to the requirements of paragraph (d)(8)(ii) of this section.

111.60–40(e)(8)(iii) *Flexible connections.* Flexible connections shall conform to the requirements of paragraph (d)(8)(iii) of this section.

111.65 SPECIAL REQUIREMENTS FOR CERTAIN LOCATIONS AND SYSTEMS

111.65–1 Application

The requirements of this subpart contain special requirements relative to electrical installations in specific areas and to specific electrical systems. Except as modified by this subpart, all other applicable rules contained in this subchapter shall also apply to such installations and systems.

★111.65–3 Special requirements for intrinsically safe systems

111.65–3(a) *Application.*

111.65–3(a)(1) Intrinsically safe systems may be installed in any hazardous area as permitted by Paragraph 111.60–40(a)(3)(ii).

111.65–3(b) *General requirements.*

111.65–3(b)(1) Intrinsically safe systems shall be approved by the Commandant for each specific atmosphere.

111.65–3(b)(2) The recommended practice for Intrinsically Safe and Non-Incendive Electrical Instruments (RP 12.2) published by the Instrument Society of America is recognized as a guide for approval of intrinsically safe equipment by the Commandant.

111.65–3(c) *Submittals required for approval.*

111.65–3(c)(1) Detailed assembly drawings, list of material, wiring diagrams, and descriptions of operation. The hazardous atmosphere Class and Group as defined in Paragraph 111.60–40(a) shall be indicated.

111.65–3(c)(2) Detailed analysis of the maximum possible energy that may be released under normal and abnormal conditions.

111.65–3(c)(2)(i) The term “normal condition” means that equipment operating at maximum available voltage and current.

111.65–3(c)(2)(ii) The term “abnormal condition” means that equipment operating under conditions resulting from accidental damage to any part of the equipment or wiring, insulation or other failure of electrical components, application of overvoltage, adjustment and maintenance operations, and other similar conditions. The analysis of an "abnormal condition" of equipment will be considered to be not more than two independent faults in a combination.

111.65–3(d) *Coast Guard evaluation and test procedure.*

111.65–3(d)(1) The material submitted shall be evaluated for suitability and energy level. Subparagraph (3) of this paragraph contains data pertaining to energy level which will be used in evaluation of the material submitted.

111.65–3(d)(1)(i) Where evaluation indicates the current and voltage levels are not more than that listed in Table 111.65–3(d)(1) for ignition of the specific atmospheric mixture of the gas group involved, the requirements for testing may be waived by the Commandant.

★TABLE 111.65–3(d)(1)—*Percentage of current and voltage levels for ignition of specific atmospheric mixtures of a gas group*

	No normally operating contacts (percent)	Normally operating contacts (percent)
Normal conditions	25	25
Abnormal conditions	50	25

111.65–3(d)(1)(ii) Where evaluation indicates the current and voltage levels are more than that listed in Table 111.65–3(d)(1) for ignition of the specific atmospheric mixture of the gas group involved, or in any case where the complexity of the circuit is such that circuit analysis is not acceptable, the Commandant will require the equipment to be tested by an approved laboratory.

111.65–3(d)(2) For purposes of evaluation, energy that may be released from a capacitive and inductive circuit can be calculated by the following methods:

111.65–3(d)(2)(i) Capacitors; the maximum energy, "W," available from capacitors is the total stored energy as determined by the following formula:

$$W = \tfrac{1}{2} CV^2 \qquad (1)$$

where:
C is capacitance in farads.
V is the maximum instantaneous voltage on the capacitor in volts.
W is energy in joules.

111.65–3(d)(2)(ii) Inductors; the maximum energy available from an inductor when the current is interrupted is the total stored energy, "W," as determined by the following formula:

$$W = \tfrac{1}{2} LI^2 \qquad (2)$$

where:
W is energy in joules.
L is the inductance in henries.
I is the maximum instantaneous value of the interrupted current in amperes.

111.65–3(d)(3) Gases are grouped according to their ignitibility as specified in Section 111.60–40(a)(7). The energy required for igniting the most easily ignited mixture of a typical member of each group of gases under conditions more severe than are likely to be encountered in a practical installation have been determined by experiment. Figures 111.65–3(d)(3)(i) through 111.65–3(d)(3)(iii) are plots of the lowest level of current as a function of inductance for ignition of the specific gas group involved. Figures 111.65–3(d)(3)(iv) through 111.65–3(d)(3)(vi) are plots of the lowest level of capacitor voltage as a function of capacitance for ignition of the specific gas group involved. These plots may be used for determining acceptable current and voltage levels for use in connection with intrinsically safe calculations.

111.65–3(e) *Testing requirements.*

111.65–3(e)(1) Tests conducted for purposes of compliance with subparagraph (d)(1) of this section shall experimentally determine whether or not the most ignitible gas involved can be ignited as a result of any possible function, malfunction, or failure of the component concerned.

111.65–3(e)(2) Independent laboratories that are acceptable to the Commandant shall perform the required tests in accordance with a testing procedure approved by the Commandant. The original and 3 copies of the laboratory test report shall be submitted to the Commandant (without cost to the Coast Guard) directly by the laboratory, and one copy will be forwarded to the manufacturer when he is advised of the Commandant's actions taken under this section. The independent laboratory shall inform the Commandant in advance when designated tests will be performed so that a marine inspector may be present.

111.65–3(f) *Wiring installation.* The wiring installation for the intrinsically safe section of each approved installation shall comply with Subpart 111.60 of this part except where exempted by this subpart and:

111.65–3(f)(1) The cable insulation shall be compatible with the liquid or vapor to which it may be exposed.

Inductance vs. Current, B Group

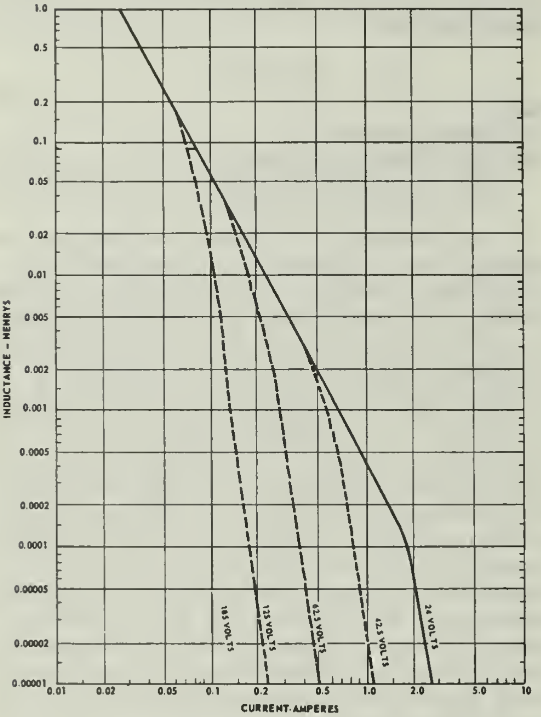


FIGURE 111.65–3(d) (3) (i)

Inductance vs. Current, D Group

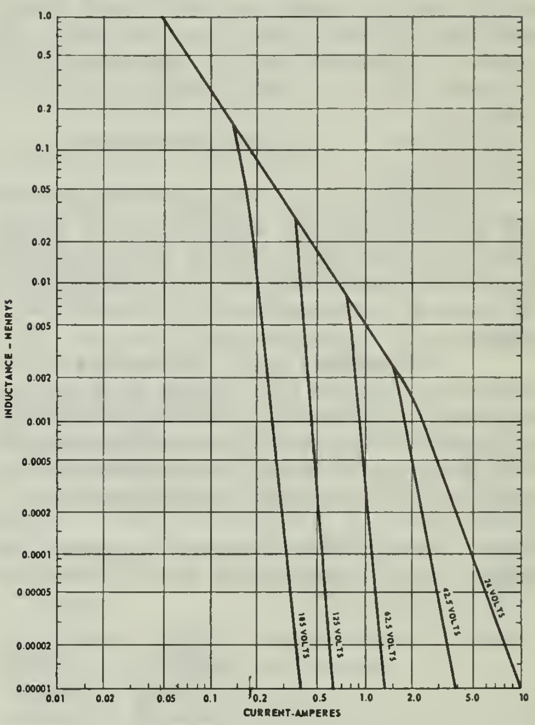


FIGURE 111.65–3(d) (3) (iii)

Inductance vs. Current, C Group

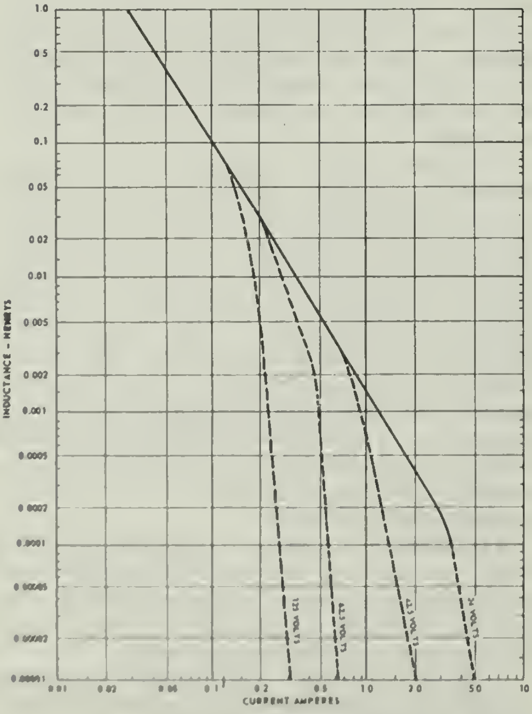


FIGURE 111.65–3(d) (2) (ii)

Capacitance vs. Voltage, B Group

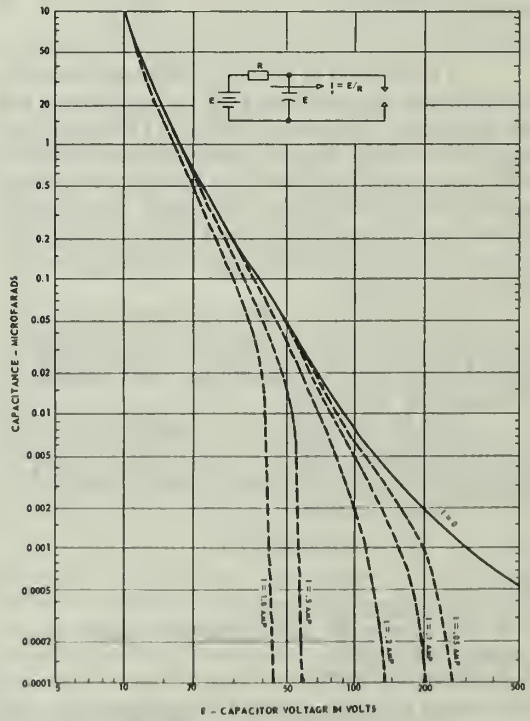


FIGURE 111.65–3(d) (3) (iv)

Capacitance vs. Voltage, C Group

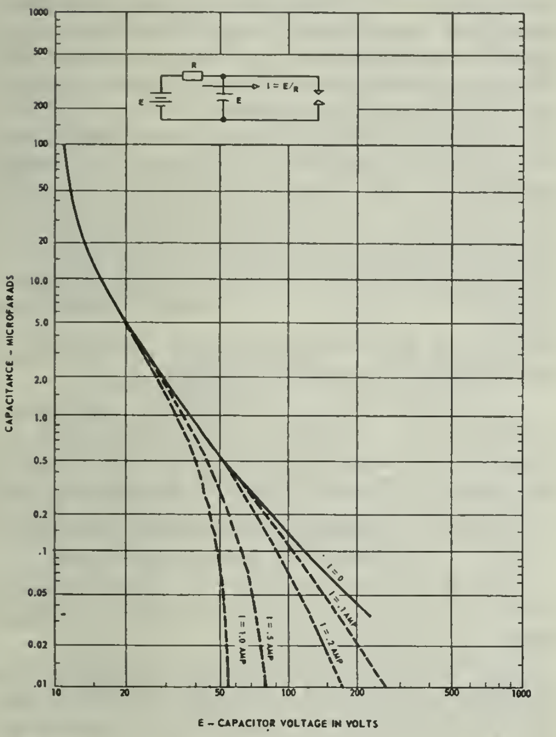


FIGURE 111.65–3(d)(3)(v)

Capacitance vs. Voltage, D Group

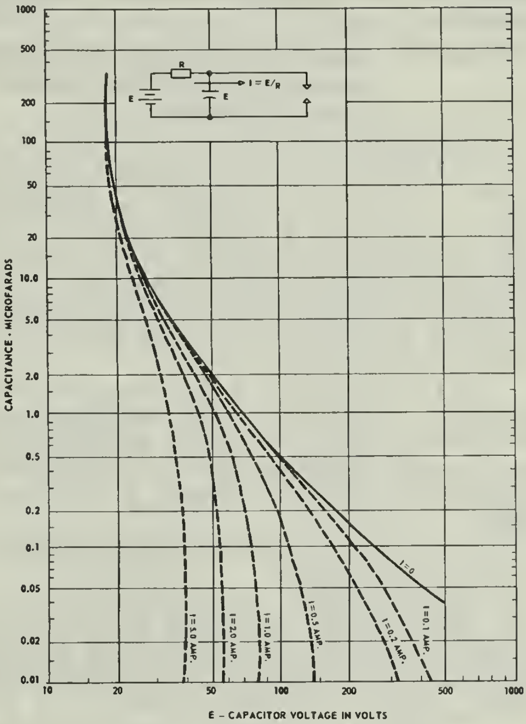


FIGURE 111.65–3(d)(3)(vi)

111.65–3(f)(2) The intrinsically safe conductors shall be separated from all other conductors to insure that the intrinsically safe circuit is not compromised by becoming energized by other conductors through damage or failure of insulation or by induction from other sources.

111.65–5 Special requirements for hospital operating rooms

111.65–5(a) *Application.* The requirements of this section are applicable to any area of a hospital in which it is intended to administer to a patient any combustible anesthetic agent in the course of examination or treatment, and to any room used for storage of combustible anesthetic or disinfecting agents.

111.65–5(b) *General requirements.* The electrical installations and electrical equipment in anesthetizing locations and in storage locations for combustible anesthetic or disinfecting agents shall comply with "Code for Use of Flammable Anesthetics (Safe Practice for Hospital Operating Rooms)" published by National Fire Protection Association. The requirements of "Class I, Group C, Division 1 locations of Article 500 of the National Electrical Code" as referred to in "Code for Use of Flammable Anesthetics (Safe Practice for Hospital Operating Rooms)" shall be construed to mean the requirements for Class I, Group C locations covered in paragraph 111.60–40(b).

★111.65–10 Special requirements for locations where gasoline or other highly volatile motor fuel is carried in vehicles

111.65–10(a) *Application.* The provisions of this section are applicable to spaces which are "specially suitable for vehicles" as defined in Section 70.10–44 in Subchapter H (Passenger Vessels) and Section 90.10–38 in Subchapter I (Cargo and Miscellaneous Vessels) of this chapter. Electrical requirements for spaces other than those "specially suitable for vehicles" are contained in Section 146.27–30 of Subchapter N (Dangerous Cargoes) of this chapter.

111.65–10(b) *General requirements.* Electrical equipment which tends to produce arcs or sparks, such as cutouts, switches, receptacles, lampholders, generators, motors, or other equipment having make-or-break or sliding contacts, when installed within 18 inches of the deck, shall be of a type approved for Class I, Group D locations, in accordance with Section 111.60–40(b). Electrical equipment installed at or over 18 inches above the deck shall be of the totally enclosed type or dripproof protected equipment provided with suitable guards or screens to prevent escape of sparks or hot metal particles.

111.65–15 Special requirements for motion picture projection rooms and projection equipment

111.65–15(a) *General.*

111.65–15(a)(1) *Professional type projectors.* The professional type of projectors shall be located in a projector room. Such rooms shall not be considered as a hazardous location as defined in Section 111.60–40. (The professional projector employs a 35-millimeter film which is $1\frac{3}{8}$ inches wide and has on each edge 5.4 perforations per inch.)

111.65–15(a)(2) *Nonprofessional type projectors.* Projectors of the nonprofessional or miniature type, if employing only approved slow-burning (cellulose acetate or equivalent) film, may be operated without a projection room.

111.65–15(b) *Equipment and projectors of the professional type.*

116.65–15(b)(1) *Motor-driven projectors.* Motor-driven projectors shall be approved for the purpose as an assembly or shall comply with all the conditions contained in this subparagraph.

111.65–15 (b) (1) (i) An approved projector shall be used.

111.65–15 (b) (1) (ii) An approved projector lamp shall be used.

111.65–15(b)(1)(iii) Motors shall be so designed or guarded as to prevent ignition of film by sparks or arcs.

111.65–15 (b) (1) (iv) Projectors shall be under the charge of a qualified person.

111.65–15(b)(2) *Conductor size.* Conductors supplying outlets for projectors of the professional type shall not be smaller than No. 8 AWG, and shall be of sufficient size for the projector employed.

111.65–15(b)(3) *Conductor insulation.* Conductors having a maximum operating temperature of 200° C. shall be used on all lamps or other equipment when the ambient temperature at the conductors as installed will exceed 50° C.

111.65–15(b)(4) *Flexible cords.* Cords approved for hard service shall be used on portable equipment.

111.65–15(b)(5) *Lamp guards.* Incandescent lamps in projector rooms shall be provided with guards unless otherwise protected by noncombustible shades or other enclosures.

111.65–15(b)(6) *Location of equipment.* Motor-generator sets, transformers, rectifiers, rheostats, and similar equipment for the supply or control of current to arc lamps on projectors shall, if practicable, be located in separate rooms. If placed in the projector room, they shall be so located or guarded that arcs or sparks cannot come in contact with film. Motor-generator sets shall have the commutator end or ends totally enclosed.

111.65–15(b)(7) *Equipment prohibited.* No switches, overcurrent devices, or other equipment, not normally required or used for projectors, sound reproduction, flood, or other special effect lamps or other equipment, shall be installed in projector rooms, except remote-control switches for control of auditorium lights.

111.65–15(c) *Construction of equipment and projectors of the professional type.*

111.65–15(c)(1) Projectors and enclosures for arc or incandescent lamps and associated equipment shall be of a type, listed as approved by Underwriters' Laboratories, Inc.

111.65–20 Special requirements for electric elevators and dumbwaiters

111.65–20(a) *Application.* The requirements of this section are applicable to electric elevators and dumbwaiters.

111.65–20(b) *General requirements.* The electrical control and interlock circuits of elevators and dumbwaiters shall be in accordance with USA Standards Institute Safety Code for Elevators, Dumbwaiters, and Escalators. The construction of control switches shall conform with the requirements of Underwriters' Laboratories, Inc., Standard for Elevator Electric Contacts and Elevator Hoistway Door Interlocks.

111.65–25 Special requirements for submersible motor-driven bilge pumps

111.65–25(a) *Application.* The requirements of this section are applicable to submersible motor-driven bilge pumps required on certain vessels by Subpart 55.10 of Subchapter F (Marine Engineering) of this chapter.

111.65–25(b) *General requirements.*

111.65–25(b)(1) The electric motor driving the submersible bilge pump shall be installed in an open end air bell of rugged construction and of such proportions that flooding of the compartment, in which it is located, to the bulkhead deck will not cause water to enter the motor.

111.65–25(b)(2) The motor may be of the open type provided it is protected against splashing water from the bottom.

111.65–25(b)(3) Cables to the motor shall enter through the open bottom of the air bell.

111.65–25(b)(4) The motor shall be capable of continuous operation at rated load under any condition, dry or with water in air bell at any level up to maximum.

111.65–25(b)(5) The motor controller shall be located above the bulkhead deck with a master switch at the controller and a master switch at the motor. The master switch at the motor shall be connected in such a manner that it will be completely disconnected from the circuit when the motor is started or stopped from the remote master switch.

111.65–25(b)(6) The motor shall be energized from the final source of emergency lighting and power.

111.65–30 Special requirements for electric power-operated watertight door system

111.65–30(a) *Application.* The provisions of this section are applicable to electric power-operated watertight door systems required by Subpart 73.35 of Subchapter H (Passenger Vessels) of this chapter, except that only Paragraph (g) of this section shall be applicable to installations contracted for prior to November 19, 1952.

111.65–30(b) *General requirements.* The watertight door operating system shall comply with the specification requirements of Subpart 163.001 of Subchapter Q (Specifications) of this chapter.

111.65–30(c) *Power supply.* The power supply to power-operated watertight door systems shall comply with the requirements contained in this paragraph.

111.65–30(c)(1) The source of power for electric motor-driven door operators shall be the source of the emergency lighting and power system as required by Subpart 112.15 of this chapter.

111.65–30(c)(2) If the peak current resulting from the simultaneous starting of all doors is too great for the temporary or final source of supply, the control shall be so arranged that when the central master switch is put to "close" the doors will start to close serially at intervals of not more than 3 seconds, preference being given to the doors starting with those in the lowest part of the vessel. The total time for all doors to be closed shall not exceed 60 seconds.

111.65–30(c)(3) The power supply for hydraulically-operated watertight door systems employing a hydraulic system common to more than one watertight door shall be an accumulator tank of sufficient capacity to open all doors twice and to close all doors three times and one or more motor-driven hydraulic pumps capable of being operated from the final source of the emergency lighting and power system.

111.65(c)(3)(i) The motor-driven hydraulic pumps automatically shall maintain the accumulator tank pressure within the design limits, and shall be located and controlled from above the bulkhead deck.

111.65–30(c)(3)(ii) The accumulator tank capacity required by subdivision (i) of this subparagraph shall be available when the accumulator tank pressure is at the automatic pump "cut-in" pressure.

111.65–30(c)(4) The source of power for hydraulically-operated watertight door systems employing an independent hydraulic system for each door operator shall be as required by subparagraphs (1) and (2) of this paragraph.

111.65–30(c)(5). The power supply for other types of watertight door operators shall be as approved by the Commandant.

111.65–30(d) *Distribution.* Distribution of electric power to the watertight door operators shall comply with the requirements covered in this paragraph.

111.65–30(d)(1) Distribution panelboards used in connection with watertight door systems shall be located above the bulkhead deck and shall be provided with means for locking to prevent unauthorized access to the switching devices or fuses.

111.65–30(d)(2) Feeders supplying several watertight door operators shall be located above the bulkhead deck.

111.65–30(d)(3) A separate branch circuit shall be provided for each watertight door operator.

111.65–30(e) *Overcurrent protection.* Overcurrent devices employed in watertight door system feeders and branch circuits shall be arranged to isolate a fault with as little disruption of the system as possible. The relationship between loads and rating or setting of overcurrent devices shall conform to the requirements covered in this paragraph.

111.65–30(e)(1) The rating or setting of each feeder overcurrent device shall be not less than 200 percent of its maximum load.

111.65–30(e)(2) The rating or setting of a branch circuit overcurrent device shall be not more than 25 percent of that of the feeder overcurrent device.

111.65–30(f) *Cable.* All cable used in connection with watertight door system feeder circuits or branch circuits shall be leaded and armored, impervious sheathed and armored, or mineral-insulated, metal sheathed.

111.65–30(g) *Existing vessels.*

111.65–30(g)(1) Existing arrangements, materials, and facilities previously approved but not meeting the applicable specifications or requirements set forth in paragraphs (b) through (f) of this section may be continued in service so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and minor alterations may be made to the same standards as the original installation provided that in no case will a greater departure from the standards of paragraphs (b) through (f) of this section be permitted than presently exist.

111.65–30(g)(2) All new installations or major replacements shall meet the applicable specifications or requirements for new vessels.

111.65–35 Special requirements for fire screen door holding and release systems

111.65–35(a) *Application.* When an electric fire screen door holding and release system is installed in compliance with the requirements of Part 72 of Subchapter h (Passenger Vessels) of this chapter, the provisions of this section with the exception of Paragraph (e) of this section shall apply to all installations contracted for on or after November 19, 1952. Installations contracted for prior to November 19, 1952, shall meet the requirements of Paragraph (e) of this Section.

111.65–35(b) *Definitions.*

111.65–35(b)(1) The term "firescreen door" will be used in this section to designate any self-closing door required to comply with Subparagraph 72.05–25(b) of Subchapter H (Passenger Vessels) of this chapter.

111.65–35(b)(2) The term "fire screen holding device" will be used in this section to designate any device designed and installed for the purpose of holding open a fire screen door.

111.65–35(b)(3) The term "local control station" will be used in this section to designate any manually operated device installed adjacent to a fire screen door for the purpose of releasing the door so that the fire screen door self-closing mechanism may close the door.

111.65–35(b)(4) The term "central control station" will be used in this subpart to designate any manually operated device installed to release the fire screen doors from the wheelhouse or fire control room.

111.65–35(c) *General.*

111.65–35(c)(1) The fire screen door holding and release system requirements contained in this section presuppose that the fire screen doors will be held open by electromagnets, door release being effected by deenergizing the electromagnets.

111.65–35(c)(2) The Commandant may accept any other means for fire screen door holding and releasing not less effective than the electromagnetic type covered by this Subpart.

111.65–35(d) *General requirements.*

111.65–35(d)(1) The fire screen door holding and release system shall consist of an electromagnet for each fire screen door, a self-aligning armature plate on each door to be seized and held by the electromagnet when the fire screen door is fully open, a control switch located adjacent to the door to interrupt the supply potential to the electromagnet, and a central control located in the wheelhouse or fire control room to interrupt remotely potential to all holding magnets.

111.65–35(d)(2) The fire screen door holding circuit shall be arranged so that loss of potential from any cause will release the doors, except that momentary interruptions of the circuit that may result from the operation of automatic bus-transfer devices in connection with the emergency lighting and power system, will not release the doors.

111.65–35(d)(3) The central control station shall consist of an enclosed switch, circuit breaker, or magnetic contactor of ample rating to interrupt the connected load. The switching unit shall be externally operative and maintaining in both the "hold doors" and "release doors" positions.

111.65–35(d)(4) The local control station shall consist of an enclosed externally operative fused switch having a rating of not less than 10–T amperes, 125 volts, and may be either the momentary contact type or the maintaining contact type. A single door holding magnet shall be connected to the fuse end of this local control station. Where several doors are in close proximity to each other, a single local control station switch of ample rating may be used to release simultaneously these several doors.

111.65–35(d)(5) A door-holding electromagnet shall be designed for a nominal pull of approximately 200 pounds. When the arrangement of the electrical supply involves transfer relays to transfer the supply from a normal to a temporary source, a door-holding electromagnet shall be designed so that, with a pull on the armature of 110 pounds, the armature will be held in the sealed position for approximately one-fourth second after the circuit to the electromagnet is opened. The electromagnet shall be designed for continuous duty in an ambient temperature of 50° C. with a temperature rise by thermometer measurement of not more than 55° C. for Class A insulation nor more than 75° C. for Class B insulation. The electromagnet coil shall be vacuum impregnated and the magnet enclosure shall be either dripproof or watertight.

111.65–35(d)(6) The source of power for the fire-screen door holding and release system shall be the emergency lighting and power system as required by Subpart 112.15 of this subchapter.

111.65–35(d)(7) On large vessels where the closing of all fire screen doors simultaneously would seriously interfere with firefighting operations or with the evacuation of passengers, it is recommended that the fire screen door release system be subdivided into several circuits. The circuits shall be arranged so that it will be possible to isolate any compartment in which a fire is reported by a sufficient number of closed fire screen doors effectively to stop all draft to the fire area. An effective draft stop will entail closing:

111.65–35(d)(7)(ii) All fire screen doors in the area between the main vertical zone bulkheads immediately forward and aft of the fire area.

111.65–35(d)(7)(ii) All fire screen doors in the main vertical zone bulkheads immediately forward and aft of the fire area.

111.65–35(d)(7)(iii) All fire screen doors in the next adjacent main vertical zones, forward and aft of the fire area. The fire screen door tripping arrangement shall be specifically approved for each vessel.

111.65–35(e) *Existing vessels.* Fire screen door holding and release systems on vessels contracted for prior to November 19, 1952, shall meet the requirements covered in this paragraph.

111.65–35(e)(1) Existing arrangements, materials, and facilities previously approved will be considered satisfactory so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and minor alterations may be made to the same standard as the original installation.

111.65–35(e)(2) All new installations or major replacements shall meet the applicable specifications or requirements for new vessels.

111.65–40 Special requirements of electric power-operated lifeboat winches

111.65–40(a) *Application.* The provisions of this section, with the exception of Paragraph (i) of this Section, shall apply to all vessels contracted for on or after November 19, 1952. The provisions of Paragraph (i) of this Section, shall apply to all vessels contracted for prior to November 19, 1952.

111.65–40(b) *General.* The provisions of this section supplement the requirements of subpart 160.015 of Subchapter Q (Specifications), Part 33 of Subchapter D (Tank Vessels), Part 75 of Subchapter H (Passenger Vessels) and Part 94 of Subchapter I (Cargo and Miscellaneous Vessels) of this chapter.

111.65–40(c) *General construction requirements.*

111.65–40(c)(1) Control and power circuit switches and motor controllers installed in conjunction with lifeboat winches shall be of types specifically approved for use with lifeboat winches.

111.65–40(c)(2) Switches and motor controllers shall be of a design not likely to be adversely affected by corrosion of the working parts. Particular attention shall be given to hinged parts of contactors and relays. Structural parts, such as the enclosing cases, if not constructed of corrosion-resistant materials, shall be given a durable corrosion-resistant finish.

111.65–40(c)(3) Insulating materials shall be limited to those which exhibit the lowest relative water absorption and/or the least effect of such water absorption upon the dielectric properties consistent with the other necessary characteristics.

111.65–40(c)(4) Where gaskets are used to provide a water seal between parts of an assembly, the gasket shall be secured in place in such a manner as to prevent its falling out or becoming loose when the unit is disassembled.

111.65–40(c)(5) Holes in the walls of equipment housings for the purpose of providing means for the attachment of parts on the interior thereof, or for securing covers and the like, shall not penetrate the total thickness of the housing wall.

111.65–40(c)(6) Totally enclosed units shall be provided with a needle valve or with at least one hole closed by a ¼-inch pipe plug for draining condensed moisture. The valve or hole shall be located at the bottom, or as near the bottom as practicable, of the enclosure in order that it may drain the enclosure satisfactorily.

111.65–40(c)(7) Main line emergency disconnect switches, when installed in a location accessible to passengers, shall be provided with means whereby the switch can be locked in the open-circuit position by means of a padlock or the equivalent. The switch shall have no provisions for locking in the closed-circuit position.

111.65–40(d) *Detail construction requirements.*

111.65–40(d)(1) *Enclosures.* Each enclosure for motor controller and switching devices, when installed in locations exposed to the weather, shall be capable of meeting the test requirements of Paragraph (e) of this Section.

111.65–40(d)(2) *Electrical clearances.* The minimum creepage and air clearance distance between live parts of different polarity of motor controllers, master switches, and control circuit limit switches shall be not less than the values shown in Table 111.65–40(d)(2). It is desirable to exceed these values where possible. The electrical clearances for power circuit limit switches and main line emergency disconnect switches shall be not less than the general requirements for such devices given in this part.

TABLE 111.65–40(d)(2)—*Minimum spacings in inches*

Location	Potential involved in volts		
	0–150	151–300	301–600
Between any uninsulated live part and an uninsulated live part of opposite polarity, an uninsulated grounded part other than the enclosure, or an exposed metal part.	Through air ¼	5/16	⅜
	Over surface ½	⅝	¾
Between any uninsulated live part and the walls of a metal enclosure, including fittings for cable entrance.	Through air ½	½	½
	Over surface ¾	¾	¾

111.65–40(d)(3) *Motors.* Motors shall be of waterproof construction in accordance with the general requirements of this part.

111.65–40(e) *Spraytight test.*

111.65–40(e)(1) Before conducting this test, all joints that have gaskets or sealing compounds, or that have been painted, shall be broken and reassembled 3 times; this procedure also applies to doors and to cover plates. There shall be no leakage of water into the enclosure after it has been subjected to one of the following methods of submergence for a period of 5 continuous minutes:

111.65–40(e)(1)(i) The enclosure shall be submerged in water to such a depth that the highest point of the enclosure in its normally mounted position is under a three-foot head; or

111.65–40(e)(1)(ii) The enclosure shall be submerged in water at least three inches at the highest point in an open tank. Sufficient vacuum shall then be applied to the inside of the enclosure to produce an external pressure equivalent to a 3-foot head of water.

111.65–40(e)(2) The following additional test shall be conducted immediately after either of the above tests, and while the enclosure is still submerged. An internal air pressure shall be applied for a period of 5 minutes equal to $1\frac{1}{2}$ pounds per square inch, plus a pressure equivalent to the depth of submergence.

111.65–40(e)(3) Under these tests the enclosure will be considered spraytight if no water is found inside the enclosure, and if no air bubbles are seen to emerge. Where a shaft enters the enclosure, the shaft shall be operated twice while submerged.

111.65–40(e)(4) The following formula may be used to determine the necessary vacuum:

$$M=0.074\ (12H-W) \qquad (1)$$

Where:

M=vacuum in inches of mercury,

H=equivalent head of water in feet, and

W=depth of water in inches covering the highest point of the enclosure.

111.65–40(f) *Wiring of lifeboat winch components.*

111.65–40(f)(1) When the motor controller of a lifeboat winch power unit is located adjacent to the winch, the main line emergency switch shall disconnect all parts of the lifeboat winch power unit, including the motor controller and limit switches, from all sources of potential. Any other power circuit switches employed shall be connected in series with the main line emergency switch and ahead of the motor controller. The main line emergency switch shall serve as the motor and controller disconnect required by the general requirements of this part, and shall have a horsepower rating not less than that of the winch motor.

111.65–40(f)(2) When the motor controller of a lifeboat winch power unit is remotely located with relation to the winch, a switch shall be provided at the controller arranged to disconnect the entire winch electrical installation from all sources of potential. In such cases, the main line emergency switch shall be connected in series with this circuit disconnect switch and ahead of the power circuit limit switches, when employed, and ahead of the motor controller.

111.65–40(f)(3) Davit arm limit switches, whether connected in the power circuit or in the control circuit, shall disconnect all ungrounded conductors of the circuit controlled.

111.65–40(f)(4) Where one motor is used with two winches, a main line emergency switch, a clutch interlock switch, and a master switch shall be provided for each winch, except that a single main line emergency switch located in accordance with Subparagraph (5) of this Paragraph with respect to both winches will be accepted. The main line emergency switches shall be connected in series ahead of the motor controller. The master switches shall be connected in parallel and each in series with the corresponding clutch interlock switch for that winch. The clutch interlock switches shall open the circuit to its master switch except when the power unit is clutched to the associated winch. Means shall be provided to prevent the power unit from being clutched to both winches simultaneously.

111.65–40(f)(5) Typical lifeboat winch wiring diagrams and arrangement drawings are shown on Figures 111.65–40(f)(5)(i) through 111.65–40(f)(5)(iv), the arrangement of the equipment shown being diagrammatical. The fact that some show direct-current motors and some shown alternating-current motors has no particular significance. In actual installations the main line emergency disconnect switch shall be so located as to be adjacent to the master switch; within reach of the winch operator; in a position accessible to the person in charge of the boat stowage; and in a position, for gravity davit installations, from which the movement of both davit arms can be observed as they approach the final stowed position. Special consideration will be given to other arrangements where complete compliance with these location requirements cannot be met.

111.65–40(g) *Procedure for approval of lifeboat winch electrical installations and equipment.*

111.65–40(g)(1) *Switches.* Manufacturers of master switches, limit switches, and main line emergency disconnect switches desiring to qualify their products for use in connection with lifeboat winch installations shall submit for review detail assembly drawings of the unit, identifying each part used in the assembly and the material specification, including finish, if any, of each part. After the detail assembly drawings have been reviewed sample units may be requested for testing. Units found to comply with the requirements of this section will be listed by the Coast Guard as being satisfactory for use as lifeboat winch auxiliary equipment.

FIGURE 111.65-40(f)(5)(i)

TYPICAL ELEMENTARY WIRING DIAGRAM AND ARRANGEMENT PLAN OF GRAVITY DAVIT AND BOAT WINCH EMPLOYING DOUBLE-POLE LIMIT SWITCHES AND MAIN LINE EMERGENCY SWITCH IN ACCORDANCE WITH SUBPART 160.015. SUBCHAPTER Q

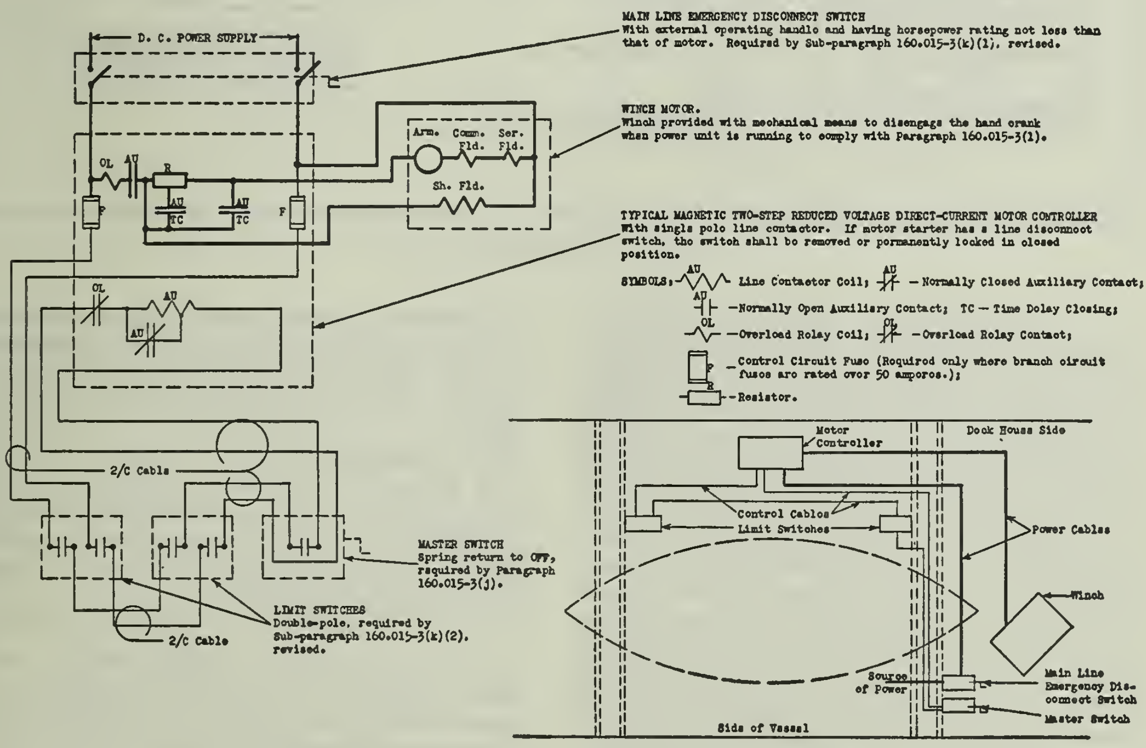
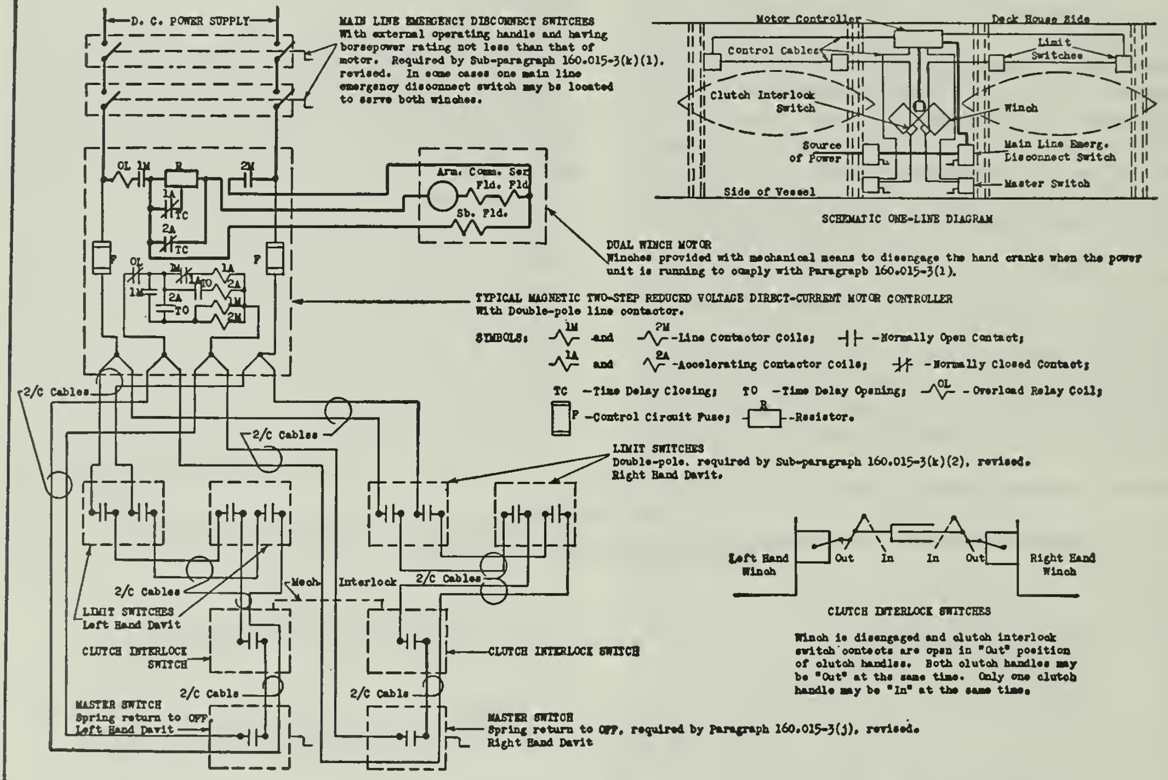

D. C. POWER SUPPLY
MAIN LINE EMERGENCY DISCONNECT SWITCH
With external operating handle and having horsepower rating not less than that of motor. Required by Sub-paragraph 160.015-3(k)(1), revised.
Arm.
Comm. Fld.
Ser. Fld.
Sh. Fld.
WINCH MOTOR.
Winch provided with mechanical means to disengage the hand crank when power unit is running to comply with Paragraph 160.015-3(l).
OL
AU
R
TC
F
TYPICAL MAGNETIC TWO-STEP REDUCED VOLTAGE DIRECT-CURRENT MOTOR CONTROLLER
With single pole line contactor. If motor starter has a line disconnect switch, the switch shall be removed or permanently locked in closed position.
SYMBOLS: AU Line Contactor Coil; AU — Normally Closed Auxiliary Contact;
AU —Normally Open Auxiliary Contact; TC — Time Delay Closing;
OL —Overload Relay Coil; OL —Overload Relay Contact;
F — Control Circuit Fuse (Required only where branch circuit fuses are rated over 50 amperes.);
R —Resistor.
2/C Cable
2/C Cable
MASTER SWITCH
Spring return to OFF, required by Paragraph 160.015-3(j).
LIMIT SWITCHES
Double-pole, required by Sub-paragraph 160.015-3(k)(2). revised.
Motor Controller
Deck House Side
Control Cables
Limit Switches
Power Cables
Winch
Source of Power
Main Line Emergency Disconnect Switch
Master Switch
Side of Vessel

FIGURE 111.65–40(f)(5)(i)

FIGURE 111.65-40(f)(5)(ii)

TYPICAL ELEMENTARY WIRING DIAGRAM AND ARRANGEMENT PLAN OF GRAVITY DAVITS AND DUAL BOAT WINCH EMPLOYING DOUBLE-POLE LIMIT SWITCHES, CLUTCH INTERLOCK SWITCHES, AND MAIN LINE EMERGENCY SWITCHES IN ACCORDANCE WITH SUBPART 160.015, SUBCHAPTER Q



MAIN LINE EMERGENCY DISCONNECT SWITCHES
With external operating handle and having horsepower rating not less than that of motor. Required by Sub-paragraph 160.015-3(k)(1), revised. In some cases one main line emergency disconnect switch may be located to serve both winches.

DUAL WINCH MOTOR
Winches provided with mechanical means to disengage the hand cranks when the power unit is running to comply with Paragraph 160.015-3(l).

TYPICAL MAGNETIC TWO-STEP REDUCED VOLTAGE DIRECT-CURRENT MOTOR CONTROLLER
With Double-pole line contactor.

SYMBOLS: 1M and 2M -Line Contactor Coils; ─┤├─ -Normally Open Contact;
1A and 2A -Accelerating Contactor Coils; -Normally Closed Contact;
TC -Time Delay Closing; TO -Time Delay Opening; OL - Overload Relay Coil;
F -Control Circuit Fuse; R -Resistor.

LIMIT SWITCHES
Double-pole, required by Sub-paragraph 160.015-3(k)(2), revised.
Right Hand Davit.

Winch is disengaged and clutch interlock switch contacts are open in "Out" position of clutch handles. Both clutch handles may be "Out" at the same time. Only one clutch handle may be "In" at the same time.

MASTER SWITCH
Spring return to OFF, required by Paragraph 160.015-3(j), revised.
Right Hand Davit

FIGURE 111.65–40(f)(5)(ii)

111.65–40(g)(2) *Motor controllers.* Manufacturers of motor controllers desiring to qualify their products for use in conjunction with lifeboat winch installations shall submit for review detail assembly drawings and material lists of the enclosing cases to be furnished, and detail assembly drawings and material lists and/or samples of contactors, relays, resistors and other motor-controller components to be employed. For each installation of lifeboat winch motor controllers there shall be submitted for approval a drawing showing the enclosure outline, front view assembly, wiring diagram, and material list, together with the name or other identification of the vessel on which the motor controllers will be installed. No general approval of motor controllers will be given.

111.65–40(g)(3) *Motors.* For each installation of lifeboat winch motors, plans as required by Section 111.05–5 shall be submitted, together with the name or other identification of the vessel on which the motor will be installed. No general approval of motors will be given.

111.65–40(g)(4) *Shipboard installation drawing.* For each shipboard installation of electric power-operated lifeboat winches, an elementary wiring diagram and isometric or deck wiring diagram as required by Section 111.05–5 shall be submitted.

111.65–40(h) *Testing of lifeboat winch electrical equipment.* The electrical equipment shall be given periodic inspections and tests as required by Part 78 of Subchapter H (Passenger Vessels) and Part 97 of Subchapter I (Cargo and Miscellaneous Vessels) of this chapter.

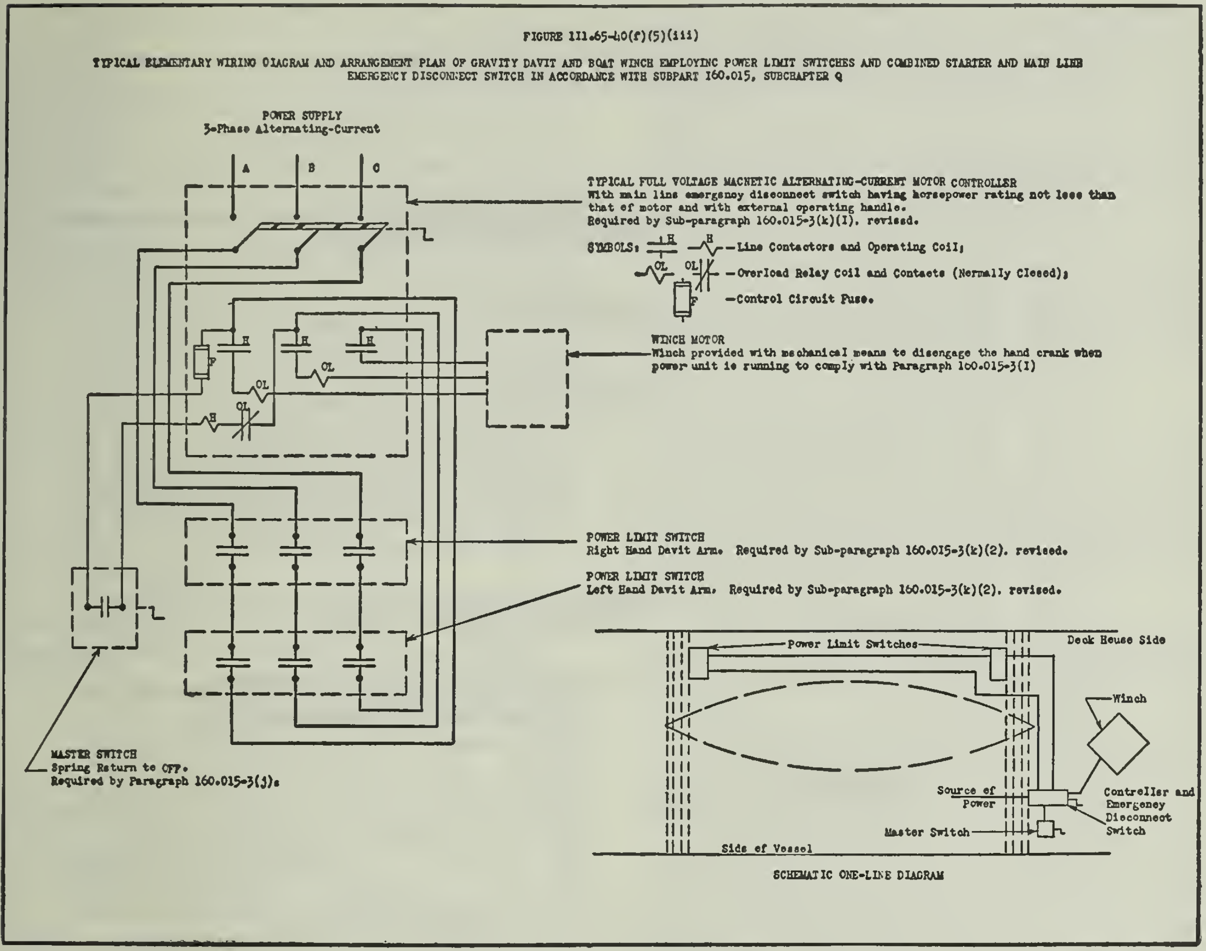


FIGURE 111.65-40(f)(5)(iii)
TYPICAL ELEMENTARY WIRING DIAGRAM AND ARRANGEMENT PLAN OF GRAVITY DAVIT AND BOAT WINCH EMPLOYING POWER LIMIT SWITCHES AND COMBINED STARTER AND MAIN LINE EMERGENCY DISCONNECT SWITCH IN ACCORDANCE WITH SUBPART 160.015, SUBCHAPTER Q
POWER SUPPLY
3-Phase Alternating-Current
A
B
C
TYPICAL FULL VOLTAGE MAGNETIC ALTERNATING-CURRENT MOTOR CONTROLLER
With main line emergency disconnect switch having horsepower rating not less than that of motor and with external operating handle.
Required by Sub-paragraph 160.015-3(k)(I). revised.
SYMBOLS: H H —Line Contactors and Operating Coil;
OL OL —Overload Relay Coil and Contacts (Normally Closed);
F —Control Circuit Fuse.
WINCH MOTOR
Winch provided with mechanical means to disengage the hand crank when power unit is running to comply with Paragraph 160.015-3(I)
H
OL
F
POWER LIMIT SWITCH
Right Hand Davit Arm. Required by Sub-paragraph 160.015-3(k)(2). revised.
POWER LIMIT SWITCH
Left Hand Davit Arm. Required by Sub-paragraph 160.015-3(k)(2). revised.
MASTER SWITCH
Spring Return to OFF.
Required by Paragraph 160.015-3(j).
Power Limit Switches
Deck House Side
Winch
Source of Power
Controller and Emergency Disconnect Switch
Master Switch
Side of Vessel
SCHEMATIC ONE-LINE DIAGRAM

FIGURE 111.65–40(f)(5)(iii)

111.65–40(i) *Electric power-operated lifeboat winches for existing vessels.*

111.65–40(i)(1) The electrical equipment installed in connection with electric power-operated lifeboat winches used with gravity davits on passenger vessels and cargo vessels contracted for prior to November 19, 1952, and on tank vessels contracted for on or after November 19, 1952 shall comply with the requirements of Paragraph 160.015–3(k) Subchapter Q (Specifications) of this chapter and with the wiring arrangements of Paragraph 111.65–40(f).

111.65–40(i)(2) New materials installed to effect compliance with this paragraph shall comply with the applicable requirements of this section. Existing materials continued in service shall comply with the requirements of this section insofar as it is reasonable and practicable.

111.65–40(i)(3) The electrical equipment installed in connection with electric power-operated lifeboat winches used with other than gravity davits on vessels contracted for prior to November 19, 1952, previously approved, but not meeting the applicable specifications or requirements set forth in paragraphs (b) through (f) of this section may be continued in service so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and minor alterations may be made to the same standards as the original installation: *Provided*, That, in no case, will a greater departure from the standards of paragraphs (b) through (f) of this section be permitted than presently exist. All new installations or major replacements shall meet the applicable specifications or requirements for new vessels.

FIGURE 111.65-40(f)(5)(iv)

TYPICAL ELEMENTARY WIRING DIAGRAM AND ARRANGEMENT PLAN OF GRAVITY DAVIT AND BOAT WINCH EMPLOYING MAIN LINE EMERGENCY SWITCH AND POWER LIMIT SWITCHES IN ACCORDANCE WITH SUBPART 160.015, SUBCHAPTER Q

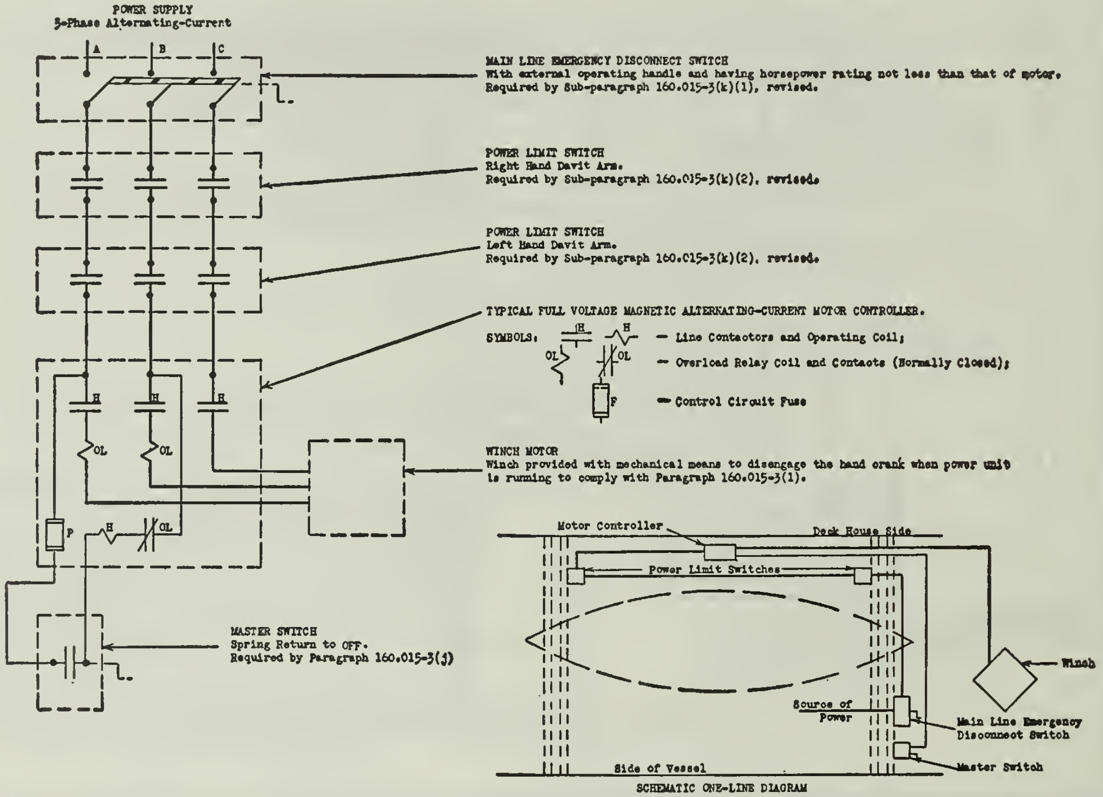

POWER SUPPLY
3-Phase Alternating-Current
A
B
C
MAIN LINE EMERGENCY DISCONNECT SWITCH
With external operating handle and having horsepower rating not less than that of motor.
Required by Sub-paragraph 160.015-3(k)(1), revised.
POWER LIMIT SWITCH
Right Hand Davit Arm.
Required by Sub-paragraph 160.015-3(k)(2), revised.
POWER LIMIT SWITCH
Left Hand Davit Arm.
Required by Sub-paragraph 160.015-3(k)(2), revised.
TYPICAL FULL VOLTAGE MAGNETIC ALTERNATING-CURRENT MOTOR CONTROLLER.
SYMBOLS:
H
H
OL
OL
F
— Line Contactors and Operating Coil;
— Overload Relay Coil and Contacts (Normally Closed);
— Control Circuit Fuse
H
H
H
OL
OL
F
H
OL
WINCH MOTOR
Winch provided with mechanical means to disengage the hand crank when power unit is running to comply with Paragraph 160.015-3(1).
MASTER SWITCH
Spring Return to OFF.
Required by Paragraph 160.015-3(j)
Motor Controller
Deck House Side
Power Limit Switches
Winch
Source of Power
Main Line Emergency Disconnect Switch
Master Switch
Side of Vessel
SCHEMATIC ONE-LINE DIAGRAM

FIGURE 111.65–40(f)(5)(iv)

111.65–45 Special requirements for electric air heaters

111.65–45(a) *Application.*

111.65–45(a)(1) The provisions of this section, with the exception of paragraph (c) of this section, shall apply to all vessels contracted for on or after November 19, 1952. The provisions of paragraph (c) of this section shall apply to all vessels contracted for prior to November 19, 1952.

111.65–45(a)(2) The provisions of this section are applicable to electrically energized units or panels to be employed in heating a room or compartment for the comfort of the occupants thereof. The provisions of this section are not applicable to electrically energized units employed to heat the air in enclosed apparatus, such as motors, controllers, or the like.

111.65–45(b) *General requirements.*

111.65–45(b)(1) Electric heaters shall be so constructed that the risk of fire is reduced to a minimum. Unspecified construction and circuit details shall be in accordance with Underwriters' Laboratories, Inc., Standard for Electric Space-Heating Equipment.

111.65–45(b)(2) Heaters shall be designed to heat the surrounding air principally by convection. Heater elements shall be of the enclosed type. The heater element case or jacket should be of a corrosion-resistant material.

111.65–45(b)(3) Heaters shall be provided with a thermal cutout of the manually-reset type that will prevent overheating and with a suitable regulating switch.

111.65–45(b)(4) Heaters for bulkhead mounting shall have their top slanted or otherwise designed to prevent hanging towels, etc., on the heater. When heaters are of the portable type, an acceptable clip or bracket shall be fitted to hold the heater in a fixed position.

111.65–45(b)(5) The external temperature of the heater enclosing case shall not exceed a temperature of 125° C., except that the external temperature of the enclosing case of flush-mounted heaters shall not exceed a temperature of 100° C. When heaters are mounted upon, or adjacent to, the deck or bulkhead, the construction of the heater shall be such that the nearest deck or bulkhead surface will not exceed a temperature of 55° C. For test purposes an ambient temperature of 25° C. will be used.

111.65–45(c) *Electric air heaters on vessels contracted for prior to November 19, 1952.*

111.65–45(c)(1) Existing arrangements, materials, and equipment previously approved shall be considered satisfactory so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and minor alterations may be made to the same standard as the original installation.

111.65–45(c)(2) All new installations or major replacements shall meet the applicable specifications or requirements for new vessels.

111.65–50 Special requirements for electric cooking equipment and motor-driven commissary equipment

111.65–50(a) *Application.* The provisions of this section, with the exception of paragraph (d) of this section, shall apply to all vessels contracted for on or after November 19, 1956. The provisions of paragraph (d) of this section shall apply to all vessels contracted for prior to November 19, 1956.

111.65–50(b) *Electric cooking equipment requirements.*

111.65–50(b)(1) All equipment, attachments and devices shall be of rugged construction and so designed as to permit complete cleaning, maintenance and repair with ease.

111.65–50(b)(2) Doors shall be provided with heavy duty hinges and locking devices to prevent accidental opening in a heavy sea.

111.65–50(b)(3) Where necessary for safety of personnel, grab rails shall be provided. Ranges shall be provided with sea rails with adjustable barriers to resist accidental cook pot movement.

111.65–50(b)(4) Means shall be provided to effect positive grease or fat collection and to prevent spillage thereof onto the deck.

111.65–50(b)(5) All equipment shall be mounted to prevent dislodgment by roll and/or pitch, whether arranged for fixed wiring or for portable wiring.

111.65–50(b)(6) Each equipment unit shall be provided with means for disconnecting it from all circuit conductors. The disconnecting means shall plainly indicate whether it is in the open or closed circuit position and shall be located in the same compartment with, and within sight of, its associated equipment. The disconnecting means may be an integral part of the equipment provided this device remains unaffected by the heat of the equipment of which it is a part.

111.65–50(b)(7) Unspecified construction and circuit details shall be in accordance with Underwriters' Laboratories, Inc., Standard for Commercial Electric Cooking Appliances.

111.65–50(c) *Motor-driven commissary equipment requirements.*

111.65–50(c)(1) All equipment shall be rigidly constructed and self-supporting, and shall be securely mounted whether arranged for fixed wiring or for portable wiring unless such mounting would defeat the utility of the equipment.

111.65–50(c)(2) The enclosures of motors and controls shall be either watertight or totally enclosed or comparable protection provided.

111.65–50(d) *Electric cooking equipment and motor-driven commissary equipment on vessels contracted for prior to November 19, 1956.*

111.65–50(d)(1) Existing arrangements, materials, and equipment previously approved shall be considered satisfactory so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and minor alterations may be made to the same standard as the original installation.

111.65–50(d)(2) All new installations or major replacements shall meet the applicable requirements for vessels contracted for on or after November 19, 1956.

111.65–55 Special requirements for electrical steering gears

111.65–55(a) *General.* This section contains requirements for steering gear installations where the main or both the main and auxiliary steering means is electric power driven and where the steering control means is electric powered. Where two steering gear power motors and two separate and independent means for controlling the rudder from the pilothouse are provided, there will be two steering systems, each consisting of a power motor, control system, and steering gear feeder. In general these two systems are to be separate on a port and starboard basis. For any different arrangement of the steering gear system, special consideration and approval will be required with the intent of obtaining a steering installation which will be equivalent to the one covered in this section.

111.65–55(b) *Disconnecting and switching means.*

111.65–55(b)(1) The steering gear power motors and control systems shall be connected to the respective steering gear branch circuits in the steering gear room. Separate means shall be provided in the steering gear room for disconnecting the motor and control systems from the power source.

111.65–55(b)(2) If a means of transfer is provided in the steering gear room so arranged that either steering gear power motor and associated control system can be connected to either of the two steering gear branch circuits, interlocks shall be provided to prevent both steering systems from being connected to the same branch circuit simultaneously.

111.65–55(c) *Control of steering gear motors and steering control systems.*

111.65–55(c)(1) Means shall be provided in the steering gear room for starting and stopping the steering gear power motors and any motors that are part of the pilothouse control system.

111.65–55(c)(2) Where two separate and independent steering control systems are installed, the means of switching shall be provided in the pilothouse to select the steering control system which is to be used for steering. This selection shall be accomplished by one operating handle but the switches for each system shall be in separate enclosures or shall be separated by suitable fire-resistant barriers. The handle shall have positions for "port control", "off", and "starboard control" with such an arrangement to necessitate the passing through the "off" position when transferring from one steering system to the other.

111.65–55(c)(3) The selecting means in the pilothouse shall be so arranged that the steering gear power motor for the steering system selected will automatically be started if not already running. Any ancillary device necessary to activate the selected remote means for controlling the rudder shall be automatically operated upon starting the steering gear power motor.

111.65–55(d) *Overcurrent protection for steering systems.*

111.65–55(d)(1) Short circuit protection only shall be provided for the control circuits of controllers of steering gear power motors and motors used for control systems. This protection shall be instantaneous and rated at 400–500 percent of the current-carrying capacity of the conductors.

111.65–55(d)(2) Indicating and alarm circuits associated with steering installations shall be provided with over-current protection in accordance with Subparagraph 111.45–10(b)(2). Pilothouse steering control systems and any other electric means for controlling the rudder remote from the steering gear room shall be provided with short circuit protection only. The protection shall be instantaneous and rated at 400–500 percent of the current-carrying capacity of the control system conductors. The protection means shall be located in the steering gear room just after the disconnecting means required by paragraph (b)(1) of this section.

111.65–55(e) *Indicating and alarm systems for steering installations.*

111.65–55(e)(1) A pilot light for each steering gear power motor and each auxiliary motor vital to the control of the rudder shall be provided at the propulsion control station, and other locations if desired, to indicate when the motors are energized.

111.65–55(e)(2) For the requirements pertaining to overload indicating lights for steering gear pilot motors, see Paragraph 111.45–5(p).

111.65–55(e)(3) The opening of a steering gear branch-circuit circuit breaker shall automatically be indicated at the propulsion control station by the sounding of an audible alarm.

111.70 SPECIAL REQUIREMENTS FOR TANK VESSELS

111.70–1 Application—TB/ALL

111.70–1(a) *General.* The requirements of this subpart contain special requirements relative to electrical installations on tank vessels. Except as modified by this subpart and regulations of Subchapter D (Tank Vessels), all other applicable regulations contained in this Subchapter J shall also apply to tank vessels.

111.70–1(b) *Symbols.* The vessels and services to which each regulation applies are indicated by letters in the heading of the section or paragraph. The first letter or two letters indicates the type of vessel and the letter or letters following the oblique line indicates the waters in which such vessels may operate. The letters are described as follows:

111.70–1(b)(1) "T" signifies a tank ship.

111.70–1(b)(2) "B" signifies a tank barge when it precedes an oblique line; or it signifies service on bays, sounds, and lakes other than the Great Lakes when it follows an oblique line.

111.70–1(b)(3) "ALL" signifies service on all waters.

111.70–1(b)(4) "O" signifies service on ocean waters.

111.70–1(b)(5) "C" signifies service on coastwise waters.

111.70–1(b)(6) "L" signifies service on Great Lakes waters.

111.70–1(b)(7) "R" signifies service on river waters.

111.70–5 Definitions

111.70–5(a) *General—TB/ALL.* Certain terms used in this subpart are defined in this section.

111.70–5(b) *Cargo—TB/ALL.* The term "cargo" means combustible liquid, flammable liquid, or liquefied flammable gas unless otherwise stated.

111.70–5(c) *Cofferdam—TB/ALL.* The term "cofferdam" means a void or empty space separating two or more compartments for the purpose of isolation or to prevent the contents of one compartment from entering another in the event of the failure of the walls of one to retain their tightness.

111.70–5(d) *Combustible liquid—TB/ALL.* The term "combustible liquid" means any liquid having a flashpoint above 80° F. (as determined from an open-cup tester, as used for test of burning oils). Combustible liquids having lethal qualities are those having the characteristics of class "B" or "C" poisons as defined in Section 146.25–10 and 146.25–15 of Subchapter N (Dangerous Cargoes) of this chapter. In the regulations of this subchapter, combustible liquids are referred to by grades, as follows:

111.70–5(d)(1) *Grade D.* Any combustible liquid having a flashpoint below 150° F. and above 80° F.

111.70–5(d)(2) *Grade E.* Any combustible liquid having a flashpoint of 150° F. or above.

111.70–5(e) *Flashpoint—TB/ALL.* The term "flashpoint" indicates the temperature in degrees Fahrenheit at which a liquid gives off a flammable vapor when heated in an open-cup tester. For the purpose of the regulations in this subchapter, flashpoints determined by other testing methods will be equivalent to those determined with an open-cup tester, as follows:

TABLE 111.70–5(e)—*Equivalent flashpoints*

Open-cup tester	Tag closed-cup tester (A. S. T. M.)	Pensky-Martens closed tester (A. S. T. M.)
° *F.*	° *F.*	° *F.*
80	75	----------------
150	------------	140

111.70–5(f) *Gas free—TB/ALL.* The term "gas free" means free from dangerous concentrations of flammable or toxic gases.

111.70–5(g) *Flammable liquid—TB/ALL.* The term "flammable liquid" means any liquid which gives off flammable vapors (as determined by flashpoint from an open-cup tester, as used for test of burning oils) at or below a temperature of 80° F. Flammable liquids having lethal qualities are those having the characteristics of class "B" or "C" poisons as defined in Sections 146.25–10 and 146.25–15 of Subchapter N (Dangerous Cargoes) of this chapter. Flammable liquids are referred to by grades, as follows:

111.70–5(g)(1) *Grade A.* Any flammable liquid having a Reid[1] vapor pressure of 14 pounds or more.

111.70–5(g)(2) *Grade B.* Any flammable liquid having a Reid[1] vapor pressure under 14 pounds and over 8½ pounds.

111.70–5(g)(3) *Grade C.* Any flammable liquid having a Reid[1] vapor pressure of 8½ pounds or less and a flashpoint of 80° F. or below.

★111.70–5(h) *Liquefied flammable gas—TB/ALL.* The term "liquefied flammable gas" means any flammable gas having a Reid[1] vapor pressure exceeding 40 pounds, which has been liquefied.

111.70–5(i) *Tank barge—B/ALL.* The term "tank barge" means any tank vessel not equipped with means of self-propulsion.

111.70–5(j) *Tankship—T/ALL.* The term "tank ship" means any tank vessel propelled by power or sail.

111.70–5(k) *Tank vessel—TB/ALL.* The term "tank vessel" means any vessel especially constructed or converted to carry liquid bulk cargo in tanks.

111.70–10 Special requirements for tank vessels contracted for on or after November 19, 1955—TB/ALL

111.70–10(a) *Application.* The requirements of this section apply to all tank vessels contracted for on or after November 19, 1955.

111.70–10(b) *General.* The special installation requirements, in a general manner, are contained in Section 32.45–1 of Subchapter D (Tank Vessels) of this chapter, and, in some instances and to some degree, are repeated in this section for completeness of this subchapter.

111.70–10(b)(1) *Cable location.* Where practicable, electric cable shall be located well inboard from the sides, preferably along or near the centerline, to reduce the risk of injury in the event of collision, but it shall be kept clear of cargo tank openings. Specific additional requirements for cargo pumprooms and enclosed spaces immediately above or adjacent to cargo tanks are covered in paragraph (c) of this section.

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[1] American Society for Testing Materials Standard D–323 (most recent revision), Method of Test for Vapor Pressure of Petroleum Products (Reid Method).

111.70–10(b)(2) *Equipment location.* Except where Grade E liquids only are involved, switchboards, distribution panels, switches, fuses, and other circuit interrupting or power devices shall not be installed in cargo pumprooms nor in enclosed spaces immediately above or adjacent to cargo tanks. Regardless of the grade of liquid cargo handled by a tank vessel, storage batteries shall not be located in cargo pumprooms.

111.70–10(b)(3) *Explosionproof installations.* Where explosionproof equipment is required, the equipment and installation thereof shall comply with Section 111.60–40 of this part.

111.70–10(b)(4) *Portable equipment.* Illumination may be obtained in any compartment by the use of approved explosionproof, self-contained, battery-fed lamps. Otherwise, no portable electrical equipment of any type shall be used in bulk cargo tanks, fuel oil tanks, cargo pumprooms, or enclosed spaces immediately above or adjacent to bulk cargo tanks unless all the following conditions are met:

111.70–10(b)(4)(i) The compartment itself is gasfree.

111.70–10(b)(4)(ii) The compartments adjacent and diagonally adjacent are either (*a*) gasfree, (*b*) inerted, (*c*) filled with water, (*d*) contain Grade E liquid and are closed and secured, or (*e*) are spaces in which flammable vapors and gases normally are not expected to accumulate; and,

111.70–10(b)(4)(iii) All other compartments of the vessel in which flammable vapors and gases normally may be expected to accumulate are closed and secured.

111.70–10(c) *Installation requirements on tank vessels handling Grade A, B, C or D liquid cargo.* The requirements of this paragraph apply only to tank vessels handling Grade A, B, C or D liquid cargo.

111.70–10(c)(1) *Lighting of cargo pumprooms.*

111.70–10(c)(1)(i) Except as otherwise permitted by subdivision (ii) of this subparagraph, cargo pumprooms shall be lighted through permanently fixed glass lenses fitted in the bulkhead and/or overhead. Each fixed glass lens shall be of rugged construction and arranged to maintain the watertight and gastight integrity of the structure. The fixed glass lens may form a part of a lighting fixture provided that all of the following conditions are complied with: (*a*) No means of access to the interior of the fixture from the pumproom is provided; (*b*) The fixture is vented to the engineroom or a similar nonhazardous area; (*c*) The fixture is wired from outside the pumproom; and (*d*) The maximum observable temperature on the pumproom surface of the glass lens based on an ambient temperature of 40° C. shall not exceed 180° C.

111.70–10(c)(1)(ii) Where the location of a cargo pumproom does not permit the lighting arrangement of subdivision (i) of this subparagraph, or where the lighting arrangement of subdivision (i) of this subparagraph, if used, would not provide the required illumination, approved explosionproof lighting fixtures may be installed. Specific approval by the Commandant is required for the installation of approved explosionproof lights, associated wiring and accessories.

111.70–10(c)(2) *Lighting of enclosed spaces.* Lighting of the enclosed spaces immediately above or adjacent to cargo tanks either shall comply with the requirements of subparagraph (1) of this paragraph applicable to cargo pumprooms or may be effected or supplemented by means of explosionproof fixtures located in these spaces.

★111.70–10(c)(3) *Cable.* Through runs of electric cable, regardless of how they may be protected, are prohibited in cargo pumprooms, except where permitted by Section 111.65–3. In any enclosed space immediately above or adjacent to cargo tanks other than cargo pumprooms, through runs of electric cable are permitted.

★111.70–10(c)(4) *Weather decks.* Motors, their control equipment, and other electrical equipment and installations located on or above the weather decks within 10 feet of the cargo tank openings, cargo pumproom doors or ventilation outlets, or cargo tank vent terminations shall be explosionproof. Explosionproof equipment installed in locations exposed to the weather shall be waterproof or shall be enclosed in watertight housings, or protected against the entrance of water by other approved means.

111.70–90 Special requirements for tank vessels constructed prior to November 19, 1955—TB/ALL

111.70–90(a) *General installation requirements for tank vessels the construction or conversion of which was started on or after November 10, 1936, but prior to November 19, 1955*

111.70–90(a)(1) *Application.* The requirements of this paragraph shall apply to all tank vessels the construction or conversion of which was started on or after November 10, 1936, but prior to November 19, 1955.

111.70–90(a)(2) *General.* The electrical installation shall be in compliance with this Paragraph, and to the extent that such installation is not covered by this paragraph, it shall be at least equivalent to the Commandant's general requirements.

111.70–90(a)(3) *Existing arrangements.*

111.70–90(a)(3)(i) Existing arrangements, materials, and facilities previously approved will be considered satisfactory so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs or minor alterations may be made to the same standard as the original installation.

111.70–90(a)(3)(ii) Any major change in the electrical installation or any conversion shall comply with the requirements covered by Sections 111.70–1 and 111.70–10.

111.70–90(a)(4) *Location of cables.* Where practicable, electrical cable is to be located well inboard from the sides, preferably along or near the centerline, to reduce the risk of injury in the event of collision, but it shall be kept clear of cargo tank openings. Except where Grade E liquids only are involved, feeders shall be run as far as practicable to avoid cargo pump rooms and enclosed spaces immediately adjoining cargo tanks.

111.70–90(a)(5) *Cable armor.* The armor on all cables shall be electrically and mechanically continuous.

111.70–90(a)(6) *Location of circuit-interrupting devices.* Except where Grade E liquids only are involved, switchboards, distribution panels, switches, fuses, and other current-interrupting devices shall not be fitted in cargo pumprooms or enclosed spaces immediately adjoining cargo tanks.

111.70–90(a)(7) *Portable equipment.* Portable extension cables and fittings are to be of an approved type.

111.70–90(a)(8) *Overload protection.* Main distribution circuits shall be protected against overload by circuit breaking devices, the capacity of which shall be marked at each such device.

111.70–90(a)(9) *Storage batteries.* Storage batteries shall not be located in cargo pumprooms. The space in which they are located shall be well ventilated and they shall be protected against mechanical and electrical injury including short circuiting and overloading. Batteries shall be secured against movement, and acid batteries shall be set in leadlined trays at least 3 inches deep of at least 4-pound sheet lead.

111.70–90(a)(10) *Installations made during the Unlimited National Emergency.* Electrical equipment installed during the Unlimited National Emergency as defined in Section 110.25–5 of this subchapter and not complying with the requirements of the regulations in this subchapter may be continued in service if found to be satisfactory by the Commandant for the purpose intended.

111.70–90(a)(11) *Portable equipment.* When the vessel is not gas free, no portable electrical equipment shall be used in the cargo or fuel oil tanks, the cargo pumprooms or any enclosed space immediately above or adjacent to the bulk cargo tanks, except as permitted by Subparagraph 111.70–10(b)(4).

111.70–90(b) *Cargo pumprooms and enclosed spaces of tank vessels constructed on or after July 1, 1951, but prior to November 19, 1955.*

111.70–90(b)(1) *Application.* The requirements of this paragraph shall apply to cargo pumprooms and enclosed spaces immediately above the bulk cargo tanks of all tank vessels carrying Grade A, B, C, or D liquid cargo the construction or conversion of which vessels was started on or after July 1, 1951, but prior to November 19, 1955. There are no special restrictions in regard to the electrical installations in cargo pumprooms and enclosed spaces of tank vessels carrying only Grade E liquid cargo.

111.70–90(b)(2) *Equipment.* No electric lighting or power circuit-interrupting or power devices shall be installed in pumprooms or enclosed spaces immediately above the bulk cargo tanks. Through runs of electrical cable are permitted.

111.70–90(b)(3) *Lighting.* Lighting of pumprooms or the enclosed spaces immediately above the bulk cargo tanks shall be effected by means of approved explosionproof or magazine type lighting fixtures. When the vessel is not gas free no portable lighting equipment shall be used except as permitted by Subparagraph 111.70–10(b)(4).

111.70–90(c) *General cargo spaces of tank vessels constructed on or after July 1, 1951, but prior to November 19, 1955.* Regardless of location, general cargo spaces of tank vessels carrying Grade E liquid cargo only and constructed on or after July 1, 1951, but prior to November 19, 1955, shall have no special restrictions in regard to electrical installations.

111.70–90(d) *Cargo pumprooms and enclosed spaces of tank vessels constructed on or* *after November 10, 1936, but prior to July 1, 1951.*

111.70–90(d)(1) *Application.* The requirements of this paragraph shall apply to cargo pumprooms for Grade A, B, C or D liquid and to enclosed spaces required to segregate Grade A, B, C or D liquid cargo tanks from other spaces, all on tank vessels the construction or conversion of which was started on or after November 10, 1936, and prior to July 1, 1951.

111.70–90(d)(2) *Wiring.* Wiring is to be leaded and armored and shall be run through approved gastight fittings having stuffing glands at inlets and outlets.

111.70–90(d)(3) *Boxes.* Joints in wiring shall be made only in wiring appliances, such as junction boxes, outlet boxes, etc., and such boxes shall be completely metallic and shall be gastight.

111.70–90(d)(4) *Lighting fixtures.* Lighting fixtures shall be of approved type.

111.70–90(d)(5) *Motors.* Electric motors shall be of approved type either totally enclosed or ventilated to the atmosphere by suction and discharge air ducts. Separately ventilated motors are to have pressure type ventilation and shall be arranged with an automatic shutoff to open the circuit when the ventilating fan motor stops. The system is to be so interlocked that the pump motor cannot be started prior to a circulation of air. The air ducts are to lead to and from the atmosphere outside the pumproom and are to terminate not less than 3 feet above the deck and not less than 6 feet from any cargo tank vent. (See Section 32.60–20 of Subchapter D (Tank Vessels) of this chapter.)

111.70–90(e) *General installation requirements for tank vessels the construction or conversion of which was started prior to November 10, 1936.*

111.70–90(e)(1) *Application.* The requirements of this paragraph shall apply to all steel hull tank vessels the construction or conversion of which was started prior to November 10, 1936.

111.70–90(e)(2) *General requirements.* The electrical installation shall be maintained in a safe and in a good mechanical condition, and shall comply with the regulations in effect when the vessel was built, or to the requirements of a recognized classification society. Any major change in the electrical installation or any conversion shall comply with the requirements covered by Sections 111.70–1 and 111.70–10.

111.70–90(e)(3) *Pumprooms and enclosed spaces.* The electrical installation in pumprooms and enclosed spaces immediately adjoining cargo tanks (except in pump-engine rooms as provided in Section 32.70–20 of Subchapter D (Tank Vessels) of this chapter) of steel hull tank vessels handling Grade A, B, C, or D products shall be made to comply with Sections 111.55–1, 111.55–15, 111.60–5, 111.70–10(b)(1), 111.70–10(b)(2), 111.70–90(a)(2), 111.70–90(a)(9), 111.70–90(b), and 111.70–90(d), to the extent that the changes required are, in the opinion of the Officer in Charge, Marine Inspection, necessary in the interest of safety.

111.70–90(e)(4) *Portable equipment.* When the vessel is not gas free, no portable electrical equipment shall be used in the cargo or fuel oil tanks, the cargo pumprooms, or any enclosed space immediately above or adjacent to the bulk cargo tanks, except that lighting in these spaces may be effected by the use of approved explosionproof, self-contained, battery-fed lamps.

111.90 ELECTRICAL EQUIPMENT AND INSTALLATIONS ON VESSELS CONTRACTED FOR PRIOR TO NOVEMBER 19, 1952

111.90–1 General

The electrical installations on existing vessels shall be maintained in good electrical and mechanical condition to the satisfaction of the Officer in Charge, Marine Inspection.

111.90–5 Major alterations

111.90–5(a) Major alterations and major extensions to electrical installations on existing vessels shall be made to the same standard as required for new vessels. Minor repairs and minor alterations may be made to the same standard as the original installation as described in Sections 111.70–90, 111.90–10, 111.90–15, 111.90–20, and 111.90–25: *Provided*, That, in no case, will a greater departure from the standards of this subchapter be permitted than presently exist.

111.90–10 Vessels contracted for prior to July 2, 1937

111.90–10(a) Except as otherwise provided for tank vessels in Section 111.70–90, the installation on vessels contracted for between June 30, 1928, and July 1, 1937, inclusive, using electricity for any purpose, shall be in keeping with the best modern practice.

111.90–10(b) Except as otherwise provided for tank vessels in Section 111.70–90, the changes or alterations in the electrical installations on vessels contracted for prior to June 30, 1928, shall be in accordance with the requirements of this section.

111.90–15 Vessels contracted for between July 2, 1937, and January 1, 1939

111.90–15(a) Except as otherwise provided for tank vessels in Section 111.70–90, the electrical installation on vessels contracted for between July 2, 1937, and January 1, 1939, inclusive, shall be in accordance with the "Recommended Practice for Electrical Installations on Shipboard," AIEE Standard No. 45, October 1930, as published by the Institute of Electrical and Electronic Engineers.

111.90–20 Vessels contracted for between January 2, 1939, and June 1, 1941

111.90–20(a) Except as otherwise provided for tank vessels in Section 111.70–90, the electrical installation on vessels contracted for between January 2, 1939, and June 1, 1941, inclusive, shall be in accordance with the "Recommended Practice for Electrical Installations on Shipboard," AIEE Standard No. 45, December 1938, as published by the Institute of Electrical and Electronic Engineers.

111.90–25 Vessels contracted for between June 2, 1941, and November 18, 1952

111.90–25(a) Except as otherwise provided for tank vessels in Section 111.70–90, the electrical installation on vessels contracted for between June 2, 1941, and November 18, 1952, inclusive, shall be in accordance with the "Recommended Practice for Electrical Installations on Shipboard," AIEE Standard No. 45, July 1940, as published by the Institute of Electrical and Electronic Engineers.

111.90–25(b) Except as otherwise provided for tank vessels in Section 111.70–90, the specification covering electrical installations titled "United States Coast Guard, Merchant Marine Inspection, Specification for Electrical Installations on Merchant Vessels," dated August 31, 1944, revised March 6, 1945, is, during the Unlimited National Emergency, applicable as alternative provisions to those contained in this section for vessels the contract for the construction of which was signed prior to September 2, 1945.

111.90–25(c) Except as otherwise provided for tank vessels in Section 111.70–90, those parts of the specification covering electrical installations titled "United States Coast Guard, Merchant Marine Inspection, Specification for Electrical Installations on Merchant Vessels," dated August 31, 1944, revised March 6, 1945, specified in paragraphs 1, 4, and 5, thereof relating to electric cable, are, during the Unlimited National Emergency, applicable as alternative provisions to those contained in this section for vessels the contract for the construction of which was signed on and after September 2, 1945.

PART 112—EMERGENCY LIGHTING AND POWER SYSTEM

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112.01 APPLICATION

112.01–1 General

The provisions of this part, with the exception of Subpart 112.90, shall apply to all vessels contracted for on or after November 19, 1952. The provisions of Subpart 112.90, shall apply to all vessels contracted for prior to November 19, 1952.

CROSS REFERENCE: See Section 110.05–3 of this subchapter for application of amendments to regulations.

112.05 GENERAL REQUIREMENTS

112.05–1 Intent

112.05–1(a) The intent of the provisions in this part is to assure that vessels are provided with a dependable, independent emergency source of electrical power with sufficient capacity to supply all those services that are necessary for the safety of the passengers and/or the crew in an emergency.

112.05–1(b) Nonemergency loads may be supplied from the emergency source only when the emergency source has adequate capacity to supply all loads that may be connected to the emergency source simultaneously.

★Table 112.05–5(a)

Size of vessel and service	Type or types of emergency source of power	Period of operation and minimum capacity of emergency source of power
PASSENGER VESSELS OVER 65 FEET IN LENGTH		
Ocean and Coastwise, 1,600 g.t. and over, and any passenger vessel, regardless of tonnage or service, where electric power-operated watertight doors are required.	Storage battery with automatic transfer gear for temporary source, and supplemented by diesel generator with automatic starting and transfer gear for final source.	½ hour. 36 hours.
Ocean and Coastwise, over 15 g.t. but less than 1,600 g.t.[1]	Storage battery with automatic transfer gear or diesel generator with automatic starting and transfer gear.	36 hours or twice the time of run, whichever is the smaller.
Other than Ocean and Coastwise, 100 g.t. and over.[1]	Storage battery with automatic transfer gear or diesel generator with automatic starting and transfer gear.	8 hours or twice the time of run, whichever is the smaller.
Other than Ocean and Coastwise, over 15 g.t. but less than 100 g.t.[1]	Storage battery or diesel generator with automatic or manual operation.[2]	8 hours or twice the time of run, whichever is the smaller.
CARGO AND MISCELLANEOUS SELF-PROPELLED VESSELS AND TANK SHIPS; BARGES WITH SLEEPING ACCOMMODATIONS FOR MORE THAN 6 PERSONS [3]		
All waters, 1,600 g.t. and over.	Storage battery or diesel generator automatic or manual operation.	12 hours.
All waters, 300 g.t. and over, but less than 1,600 g.t.	Storage battery or diesel generator, automatic or manual operation, or approved relay-controlled battery-operated lanterns.[5]	12 hours or twice the time of run, whichever is the smaller.[4]

[1] See also Section 112.05–15.

[2] See also Sections 112.35–1 and 112.35–5.

[3] Applicable to barges contracted for on or after November 19, 1958.

[4] Minimum period of operation of relay-controlled, battery-operated lanterns may be less than 12 hours but not less than 6 hours.

[5] Battery-operated lanterns shall have rechargeable batteries, shall incorporate an automatic battery charger that will maintain the battery in a fully charged condition, and shall not be readily portable.

112.05–5 Emergency source of supply

112.05–5(a) The emergency source of supply shall be of a type and capacity in accordance with Table 112.05–5(a), except as otherwise provided by Section 112.05–15.

112.05–5(b) The emergency source of supply shall be independent of the vessels' ship's service lighting and powerplant and propulsion plant.

112.05–5(c) The complete emergency installation shall function satisfactorily when the ship is inclined 22½ degrees and/or when the trim of the ship is 10 degrees.

112.05–5(d) The emergency source of supply shall be located aft of the collision bulkhead and outside the machinery casing.

112.05–5(d)(1) On passenger vessels the emergency source of supply shall be located above the bulkhead deck or above the freeboard deck, whichever is the higher.

112.05–5(d)(2) On cargo and miscellaneous vessels, including tankships and barges, the emergency source of supply shall be located above the freeboard deck, or above the uppermost continuous deck, whichever is the higher.

112.05–5(e) When a compartment containing the emergency source of electric power, or vital components thereof, adjoins a space containing either the ship's service generators or machinery necessary for the operation of the ship's service generators, all common bulkheads and/or decks shall be protected by approved "structural insulation" or other approved material. This protection shall be such as to be capable of preventing an excessive temperature rise in the space containing the emergency source of electric power, or vital components thereof, for a period of at least one hour in the event of fire in the adjoining space. Bulkheads or decks meeting Class A–60 requirements, as defined by Section 72.05–10 in Subchapter H (Passenger Vessels) of this chapter, will be considered as meeting the requirements of this paragraph.

112.05–5(f) Except for those cables used to connect equipment located in the engineroom or boilerroom, all cables emanating from the emergency switchboard shall be run so as to avoid penetrating the boundaries of the engineroom, boilerroom or the uptakes and casings of these spaces. All such cables shall be kept clear of the bulkheads and decks forming these boundaries.

112.05–5(g) The emergency switchboard shall be installed as near as practicable to the emergency source of power.

112.05–5(h) When the emergency source of power is a generator, the emergency switchboard shall be located in the same space as the emergency source of power, unless the operation of the emergency switchboard would thereby be impaired.

112.05–10 Emergency lights

★112.05–10(a) Emergency lights supplied by an automatic emergency lighting system shall form a part of the regular lighting system, and shall be continuously lighted at all times passengers or crew are aboard, except as provided by paragraph (b) of this section and Paragraph 112.05–15(c), and except when the emergency lights consist of relay-controlled battery-operated lanterns. (See footnote 5 in Table 112.05–5(a).)

112.05–10(b) Emergency lights for the illumination of boats and embarkation decks, lifeboat launching gear, wheelhouse, chartroom, and navigating instruments need not be continuously lighted and, except as provided otherwise in this paragraph, shall be controlled by switches located in the wheelhouse.

112.05–10(b)(1) On "island type" vessels, such as tankers and Great Lakes' bulk freighters, lighting for illumination of lifeboats, launching gear and embarkation areas remote from the wheelhouse island may be controlled from a central location within the island involved in lieu of from the wheelhouse.

112.05–10(c) Emergency lights shall be marked with a letter "E" of at least ½-inch in height as required by Section 78.47–33 of Subchapter H (Passenger Vessels), and Section 97.37–25 of Subchapter I (Cargo and Miscellaneous Vessels) of this chapter.

112.05–15 Emergency lighting system for small passenger vessels

112.05–15(a) Small passenger vessels, certificated to operate only between sunrise and sunset, may be permitted to operate without an emergency lighting system.

112.05–15(b) Small passenger vessels, certificated to operate not more than 15 miles offshore, may be permitted to operate without an emergency lighting system provided all of the conditions, where applicable, contained in this paragraph are complied with.

112.05–15(b)(1) The source of supply of the general lighting system must be independent of the propulsion plant.

112.05–15(b)(2) On vessels required to meet at least a one compartment standard of subdivision, the source of supply of the general lighting system must be located above the bulkhead deck.

112.05–15(c) On small passenger vessels having no sleeping accommodations for passengers and requiring not more than 10 emergency lights, the automatic emergency lighting system need not form a part of the regular lighting system and need not be continuously lighted. Individual storage-battery-operated automatic emergency lighting units will be acceptable for such vessels in lieu of a single source emergency lighting system provided the units incorporate an automatic battery charger, are not readily portable, and have sufficient capacity for not less than 6 hours continuous operation.

112.10 CLASSIFICATIONS OF EMERGENCY LIGHTING AND POWER SYSTEMS

112.10–1 General

Emergency lighting and power systems are classified in accordance with the method provided to cause the system to apply potential to the emergency loads and in accordance with the basic function of the system.

112.10–5 Manual emergency lighting and power system

A manual emergency lighting and power system is one in which a single manual operation, such as the manual operation of a switch from an "off" to an "on" position, is required to cause the emergency lighting and power system to supply power to the emergency loads.

112.10–10 Automatic emergency lighting and power system

An automatic emergency lighting and power system is one in which a specified reduction in potential from the ship's service power and lighting plant will cause the emergency lighting and power system to supply power to the emergency loads.

112.10–15 Temporary source of emergency lighting and power

A temporary source of emergency lighting and power is one of limited capacity designed to carry, for a short time, selected emergency loads while an emergency source of larger capacity is being started.

112.10–20 Final source of emergency lighting and power

A final source of emergency lighting and power is one designed to function subsequent to the termination of the temporary source.

112.15 EMERGENCY LOADS

112.15–1 Temporary emergency source loads

112.15–1(a) The emergency lighting and power loads listed in this section shall be arranged so that they can be energized from the temporary emergency source.

112.15–1(b) Navigation light indicator panel, if required by Section 113.55–25 of this subchapter.

112.15–1(c) A sufficient number of lights throughout machinery spaces to permit the performance of essential operations and observations under emergency conditions and to facilitate restoration of service.

112.15–1(d) Lighting for passageways, stairways, and escape trunks in passenger quarters, crew quarters, public spaces, machinery spaces and work spaces, adequate to permit passengers and crew readily to find their way to open decks and to lifeboat embarkation and assembly points with all watertight doors and fire screen doors closed.

112.15–1(e) Illuminated signs bearing the word "Exit" in red letters shall be installed in such locations throughout a passenger vessel so that from any portion of the vessel normally accessible to the passengers or crew, except machinery spaces, and except stores and similar spaces where the crew are not normally employed, and with all fire doors in stairway enclosures and main vertical zone bulkheads closed and all watertight doors closed, the direction of escape to the open deck will be apparent. For the purpose of this paragraph, individual staterooms and other similar small rooms will not be required to have such signs, but upon emerging from such rooms the direction of escape shall be apparent. (Also see Paragraph 111.50–15(d) of this subchapter.)

112.15–1(f) General illumination for safe operation of watertight doors, if installed and power-operated.

112.15–1(g) One or more lights in galleys, pantries, steering gear room, emergency power rooms, chartroom, wheelhouse, and crews' mess and recreation rooms.

112.15–1(h) Lighting for boat and embarkation decks and passenger assembly points for safe embarkation into the lifeboats.

112.15–1(i) Electric communication systems essential under temporary emergency conditions and which do not have an independent storage battery source of power.

112.15–1(j) Watertight door system, if installed and power-operated.

112.15–1(k) Emergency loudspeaker system, if installed.

112.15–1(l) Fire screen door holding and release system, if installed.

112.15–1(m) Supply to motor-generator or other conversion equipment where a temporary emergency source of alternating current is necessary for essential communication systems, emergency or safety requirements.

112.15–5 Final emergency source loads

112.15–5(a) The emergency lighting and power loads listed in paragraphs (b) to (i), inclusive, of this section shall be arranged so that they can be energized from the final source. It is recommended that loads listed in paragraphs (j) to (p), inclusive, of this section be arranged so that they can be energized from the final source where the capacity and character of the emergency plant will permit.

112.15–5(b) All loads listed in Section 112.15–1, as indicated.

112.15–5(c) Illumination for the safe operation of the lifeboat and liferaft launching gear and the lifeboats and liferafts in the process of, and immediately after, being launched.

112.15–5(d) Charging panels of temporary emergency battery and of starting battery for diesel engine driving emergency generator.

112.15–5(e) One of the bilge pumps, if dependent upon the emergency generator for its source of power to comply with Part 55 of Subchapter F (Marine Engineering) of this chapter.

112.15–5(f) One of the fire pumps, if dependent upon the emergency generator for its source of power to comply with Part 34 of Subchapter D (Tank Vessels), Part 76 of Subchapter H (Passenger Vessels), or Part 95 of Subchapter I (Cargo and Miscellaneous Vessels) of this chapter.

112.15–5(g) Sprinkler system pump or water spray extinguishing system pump, if dependent upon the emergency generator for its source of power to comply with Part 76 of Subchapter H (Passenger Vessels) of this chapter.

112.15–5(h) Daylight signaling lights, if installed.

112.15–5(i) Smoke detector system, if installed.

112.15–5(j) Radio installation, if installed.

112.15–5(k) Radio direction finder, if installed.

112.15–5(l) Loran, if installed.

112.15–5(m) Radar plan position indicator, if installed.

112.15–5(n) Gyrocompass, if installed.

112.15–5(o) Depth sounder, if installed.

112.15–5(p) Electric whistle and siren control, if installed.

112.15–10 Single automatically started source loads

When only a single automatically started source of emergency lighting and power is installed, the circuits listed in Section 112.15–5, as indicated, shall be arranged so that they can be energized from the single emergency source of supply.

112.15–15 Manually started source loads

112.15–15(a) When a manually started emergency lighting and power system is installed, the circuits listed in Section 112.15–5, as indicated, shall be arranged so that they may be energized from the emergency source of supply.

112.20 OPERATION OF EMERGENCY SYSTEMS HAVING BOTH A TEMPORARY AND A FINAL SOURCE OF EMERGENCY LIGHTING AND POWER

112.20–1 Emergency loads

112.20–1(a) The emergency loads listed in Subpart 112.15, as indicated, shall normally be energized from the ship's service generating plant through automatic transfer switches.

112.20–5 Failure of power from the normal source

112.20–5(a) In the event of a reduction of potential of the normal source by 15 to 40 percent of normal value, the loads listed in Section 112.15–1 shall automatically be supplied from the temporary source of emergency lighting and power. For systems in which a reduction of frequency of the normal source or final source will adversely affect the emergency system and emergency loads, suitable means shall be provided to transfer the loads listed in Section 112.15–1 to the temporary source.

112.20–10 Diesel driven emergency source of power

112.20–10(a) Simultaneous with the operation described in Section 112.20–5, the diesel engine driving the final source (emergency generator) shall automatically be started with no load connected to the emergency generator.

112.20–15 Potential of final source

112.20–15(a) When the potential of the final source (emergency generator) reaches 85 to 95 percent of normal value, the emergency loads listed in Subpart 112.15, as indicated, shall automatically be transferred to this final source.

112.20–15(b) When potential from the ship's service generating plant has been restored to normal, the emergency loads may be manually transferred to the normal source and the emergency generator manually stopped.

112.20–15(c) Should the potential of the final source (emergency generator), while supplying the emergency loads, fall below 75 to 85 percent of normal value, the temporary emergency loads shall again be transferred to the temporary source as described in Section 112.20–5.

112.25 OPERATION OF EMERGENCY SYSTEM HAVING AN AUTOMATIC STARTING DIESEL-ENGINE-DRIVEN EMERGENCY GENERATOR AS THE SOLE SOURCE OF EMERGENCY LIGHTING AND POWER

112.25–1 Emergency loads

112.25–1(a) The emergency loads listed in Section 112.15–5, as indicated, shall normally be energized from the ship's service generating plant through automatic transfer switches.

112.25–5 Reduction of potential

112.25–5(a) In the event of failure of power from the normal source, such as a reduction of potential by 15 to 40 percent of normal value, the engine driving the emergency generator shall automatically be started with no load connected to the emergency generator.

112.25–10 Operation requirements

112.25–10(a) When the potential of the emergency generator reaches 85 to 95 percent of normal value, the emergency loads shall automatically be connected to the emergency generator.

112.25–10(b) When potential from the ship's service generating plant has been restored to normal, the emergency loads may be manually transferred to the normal source and the emergency generator manually stopped.

112.30 OPERATION OF EMERGENCY SYSTEMS HAVING AN AUTOMATICALLY CONNECTED STORAGE BATTERY AS THE SOLE SOURCE OF EMERGENCY LIGHTING AND POWER

112.30–1 Emergency loads

112.30–1(a) The emergency loads listed in Section 112.15–5, as indicated, shall normally be energized from the ship's service generating plant through automatic transfer switches.

112.30–5 Reduction of potential

112.30–5(a) Upon reduction of potential from the normal source by 15 to 40 percent of normal value, the emergency loads shall automatically be disconnected from the normal source and connected to the emergency storage battery.

112.30–10 Operation requirements

112.30–10(a) Upon restoration of potential from the normal source of 85 to 95 percent of normal values, the emergency loads shall automatically be transferred back to the normal source.

112.35 OPERATION OF A MANUALLY CONTROLLED EMERGENCY SYSTEM HAVING A STORAGE BATTERY OR A DIESEL-ENGINE-DRIVEN GENERATOR AS THE SOLE SOURCE OF EMERGENCY LIGHTING AND POWER

112.35–1 Manual operation requirements

112.35–1(a) Manually started emergency lighting and power systems shall require only a single manual operation, such as the manual operation of a switch from an "off" to an "on" position, to cause the emergency system to supply its connected loads.

112.35–5 Means for starting

112.35–5(a) The starting means shall be located in the wheelhouse or so as to be under the control of the chief engineer.

112.40 INSTALLATIONS REQUIRING AN ALTERNATING-CURRENT TEMPORARY SOURCE OF SUPPLY

112.40–1 General requirements

112.40–1(a) Installations requiring alternating current for the operation of communication equipment or other apparatus essential under temporary emergency conditions shall be provided with the necessary conversion equipment. Where such conversion equipment will be operating both under normal conditions and under temporary emergency conditions, the conversion equipment shall be provided in duplicate.

112.45 VISIBLE INDICATORS AND TEST SWITCH

112.45–1 Visible indicators

112.45–1(a) Visible indicators shall be provided in the machinery space to indicate when the emergency battery is being discharged and when the emergency loads are being supplied by an automatically controlled emergency source of supply (storage battery or emergency diesel generator).

112.45–5 Test switch

112.45–5(a) A test switch shall be provided at the emergency switchboard or other location as may be approved to simulate a failure of potential from the normal source, the operation of which switch will cause the emergency loads to be transferred.

112.50 EMERGENCY DIESEL–ENGINE-DRIVEN GENERATOR SETS

112.50–1 General requirements

112.50–1(a) The diesel engine of the generator set shall be complete with all accessories necessary for operation and protection of the engine, shall have a self-contained cooling system of size to assure continuous engine operation using 100° F. air, and the fuel used shall have a flashpoint of not less than 110° F. The room in which the set is located shall be provided with suitable intake and exhaust ducts to supply adequate cooling air. The diesel engine as installed shall be without starting aid except that a thermostatically controlled electric water jacket heater, connected to the final emergency bus, may be employed. The diesel engine as installed shall be capable of carrying its full rated load within 20 seconds after cranking is initiated with the intake air, room ambient, and starting battery all at a temperature of 32° F. The diesel engine shall be electric starting unless otherwise approved, and the starting battery shall be of sufficient capacity to provide six consecutive cycles of cranking, each cycle to consist of approximately one-half minute of cranking at a speed recommended by manufacturer followed by approximately one minute of battery rest, with the intake air, room ambient, and starting battery at a temperature of 32° F. At the end of the sixth cycle of cranking, the battery voltage while cranking the engine, shall be not less than 50 percent of nominal voltage. The diesel-engine-driven generator set shall lubricate and operate satisfactorily when permanently inclined to an angle of 22½ degrees athwartship and 10 degrees fore and aft, and shall be arranged so that it will not spill oil under a vessel roll of 30 degrees each side of the vertical. Units depending on forced lubrication shall be provided with an audible alarm device to sound on loss of oil pressure while running.

112.50–1(b) Hydraulic means of starting the diesel engine will be considered equally acceptable to the electric means described in paragraph (a) of this Section provided all the following conditions are met:

112.50–1(b)(1) The hydraulic cranking device shall be a self-contained system which will provide the required cranking forces and engine starting RPM as recommended by engine manufacturer.

112.50–1(b)(2) Electrically operated means shall automatically provide and maintain the stored hydraulic pressure within the predetermined pressure limits.

112.50–1(b)(3) The means of automatically maintaining the hydraulic system within the predetermined pressure limits shall be energized from the final emergency bus.

112.50–1(b)(4) Means shall be provided to manually recharge the hydraulic system.

112.50–1(b)(5) Charging of the hydraulic cranking system shall not create an absence of hydraulic power for engine starting at any time.

112.50–1(b)(6) The capacity of the hydraulic cranking system shall provide not less than 6 cranking cycles. Each cranking cycle shall provide the necessary number of revolutions at the required RPM to permit the diesel engine to meet the requirements of carrying its full rated load within twenty seconds after cranking is initiated with intake air, room ambient temperature and hydraulic cranking system at 32° F.

112.50–1(b)(7) Capacity of the hydraulic cranking system sufficient for three starts under conditions of subparagraph (6) of this paragraph shall be held in reserve and arranged so that the operation of a single control by one person will isolate the discharged or initially used part of the system and permit the reserve capacity to be employed.

112.55 STORAGE BATTERY INSTALLATION

112.55–1 General requirements

112.55–1(a) Storage batteries for emergency lighting and power systems, including starting batteries for emergency diesel-engine driven generator sets, shall be of a design and construction proven successful in merchant marine service, and capable of withstanding the roll and pitch of a vessel and exposure to salt air. Positive plates of lead-acid batteries shall be at least 0.25 inch thick, and the specific gravity of the electrolyte when fully charged shall be 1.210 to 1.220, both inclusive, at 25° C., except that thin positive plate construction (0.125 inch thick minimum) may be used for engine cranking batteries. The fully charged specific gravity of the electrolyte of lead-acid engine cranking batteries shall not exceed 1.260 at 25° C. for high watering space type batteries or 1.285 at 25° C. for normal watering space type batteries.

112.55–5 Emergency lighting loads

112.55–5(a) When supplying emergency lighting loads, the storage battery initial voltage shall not exceed the standard system voltage by more than 5 percent.

112.55–10 Storage battery requirements

112.55–10(a) Storage battery installations for emergency lighting and power, including starting batteries for emergency diesel-engine driven generator sets, shall include the necessary apparatus automatically to maintain the battery in a fully charged condition. At all times when the ship's service source of supply is available, the battery shall be furnished a continuous trickle charge, except that after a battery discharge, the battery shall be automatically charged at a higher rate until the battery voltage increases to a predetermined point. Charging operations shall not create an absence of battery power at any time. Instruments to show the rate of charge shall be provided.

112.55–15 Capacity of storage battery

112.55–15(a) The capacity of a storage battery shall be ample to close each watertight door three times and to open each watertight door two times, and to carry the remaining emergency loads continuously for the duration of time required by Paragraph 112.05–5(a), at the end of which time the potential of the storage battery shall be not less than 87.5 percent of standard system voltage. The nominal potential of a lead-acid storage battery will be taken as 2.0 volts per cell; the nominal potential of nickel-alkaline storage batteries will be taken as from 1.2 to 1.4 volts per cell.

112.55–20 Diesel engine cranking batteries

112.55–20(a) Batteries used for starting emergency diesel engine generator sets shall be either the lead-acid or nickel-cadmium type.

112.90 EMERGENCY LIGHTING AND POWER SYSTEMS FOR VESSELS CONTRACTED FOR PRIOR TO NOVEMBER 19, 1952

112.90–1 General

112.90–1(a) Existing arrangements, materials, and facilities previously approved, but not meeting the applicable specifications or requirements set forth in Subparts 112.05 through 112.55, may be continued in service so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and minor alterations may be made to the same standards as the original installation: *Provided*, That, in no case, will a greater departure from the standards of Subparts 112.05 through 112.55 be permitted than presently exist.

112.90–1(b) All new installations or major replacements shall meet the applicable specifications or requirements for new vessels.

112.90–5 Emergency lighting system for ocean and coastwise passenger vessels contracted for prior to November 19, 1952

112.90–5(a) The emergency lighting system for ocean and coastwise passenger vessels contracted for prior to November 19, 1952, shall be in accordance with this section.

112.90–5(b) Provision shall be made on all passenger vessels for an electric or other system of lighting, sufficient for all requirements of safety, in the different parts of the ship. There shall be a self-contained source capable of supplying, when necessary, this safety lighting system, and placed in the upper parts of the ship above the margin line.

112.90–5(c) The exit from every main compartment occupied by passengers or crew shall be continuously lighted by an emergency lamp. The power for these emergency lamps shall be so arranged that they will be supplied from the independent installations referred to in paragraph (b) of this section in the event of failure of the main generating plant.

112.90–5(d) On all passenger vessels contracted for on and after July 1, 1935, or where existing emergency installations operated by internal combustion engines are replaced, the emergency generator shall be driven by a diesel or semi-diesel engine, equipped with means for quick starting. Such emergency equipment shall be located in steel or iron compartments or rooms on the deck above the weather deck and isolated from the passenger and crew quarters. Where existing installations of emergency engines and generators are located in wooden compartments or rooms, such compartments or rooms shall be made fire-resistant by lining same with asbestos board having a thickness of not less than one-quarter inch over which iron or steel sheathing shall be fitted.

112.90–5(e) Provision shall be made on all passenger vessels, where the boat deck is more than 30 feet above the waterline at the lightest seagoing draft, for readily and continuously available illumination from the vessel of lifeboats when alongside and in process of, or immediately after, being launched. There shall be a self-contained source capable of supplying, when necessary, this safety lighting system and placed in the upper part of the vessel above the bulkhead deck.

112.90–5(e)(1) The emergency generating set will ordinarily provide a satisfactory source of illumination, and, where used for this purpose, it shall be of sufficient power to provide for such illumination in addition to other demands made upon the set.

112.90–10 Emergency lighting system for passenger vessels other than ocean and coastwise passenger vessels contracted for prior to November 19, 1952

112.90–10(a) The emergency lighting system for passenger vessels other than ocean and coastwise passenger vessels contracted for prior to November 19, 1952, shall be in accordance with this section.

112.90–10(b) All vessels engaged in the passenger service, which are electrically lighted by dynamos or other electric units, located below the deep-load line of the vessel, shall have on board an emergency electric lighting system located above the deep-load line to light the vessel sufficiently to enable the passengers and crew to find their way to the exits in the event of failure of the main lighting system. The emergency lighting system shall at all times be ready for immediate use, and shall be installed and arranged so that all emergency lights may be switched on from the pilothouse, navigation bridge, or a central station.

112.90–10(c) On all passenger vessels contracted for on and after July 1, 1935, or where existing emergency installations operated by internal-combustion engines are replaced, the emergency generator shall be driven by a diesel or semi-diesel engine, equipped with means for quick starting. Such emergency equipment shall be located in steel or iron compartments or rooms on the deck above the weather deck and isolated from the passenger and crew quarters. Where existing installations of emergency engines and generators are located in wooden compartments or rooms, such compartments or rooms shall be made fire-resistant by lining same with asbestos board having a thickness of not less than one-quarter inch over which iron or steel sheathing shall be fitted.

112.90–10(d) Provision shall be made on all passenger vessels, where the boat deck is more than 30 feet above the waterline at the lightest seagoing draft, for readily and continuously available illumination from the vessel of lifeboats when alongside and in process of, or immediately after, being launched. There shall be a self-contained source capable of supplying, when necessary, this safety lighting system and placed in the upper part of the vessel above the bulkhead deck.

112.90–10(d)(1) The emergency generating set will ordinarily provide a satisfactory source of illumination, and, where used for this purpose, it shall be of sufficient power to provide for such illumination in addition to other demands made upon the set.

PART 113—COMMUNICATION AND ALARM SYSTEMS AND EQUIPMENT

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113.01 APPLICATION

113.01–1 Vessels subject to requirements

113.01–1(a) The provisions of this part shall apply to all vessels except as specifically noted in this part.

113.05 GENERAL PROVISIONS

113.05–1 Supplementary requirements

113.05–1(a) The provisions of this part are supplementary to the general requirements for electrical systems and apparatus contained in this subchapter.

113.05–5 Equipment of an approved type

113.05–5(a) Where equipment in this part is required to be of an approved type, such equipment shall be of a type approved by the Commandant.

113.05–5(b) Specifications for many of the items required to be of an approved type have been promulgated and are contained in Subchapter Q (Specifications) of this chapter. In general, such specifications are of interest only to the manufacturer of specific items of equipment.

113.05–10 Wiring

113.05–10(a) Hook-up wire for use within the components of the equipment specified in this part shall be of soft stranded annealed copper of suitable cross section to provide ample and safe current carrying capacity and mechanical strength. Hook-up wire shall be in accordance with MIL–W–76, MIL–W–16878 types B, C, D, E, EE, and FF, or with Subpart 111.60 of this subchapter.

113.05–10(b) All external wiring and wiring between components shall be in accordance with Subpart 111.60 of this subchapter.

113.10 AUTOMATIC FIRE DETECTING AND ALARM SYSTEMS

113.10–1 Application

113.10–1(a) Where an electric fire detecting and alarm system is installed, the provisions of this subpart, with the exception of Section 113.10–90, shall apply to all installations contracted for on or after November 19, 1952. Installations contracted for prior to November 19, 1952, shall meet the requirements of Section 113.10–90.

113.10–1(b) For the vessels on which an automatic fire detecting and alarm system is required see Part 76 of Subchapter H (Passenger Vessels) of this chapter.

113.10–5 General requirements

113.10–5(a) Fire alarm annunciators, power supply, fire detectors, test stations, and vibrating bells shall be of a type approved by the Commandant. Systems installed on vessels contracted for on or after November 19, 1959, shall meet the requirements of Subpart 161.002 of Subchapter Q (Specifications) of this chapter.

113.10–5(b) All electric cables installed in conjunction with fire detecting and alarm system shall be either leaded and armored, impervious sheathed and armored or mineral insulated metal sheathed.

113.10–5(c) Cable runs between the fire alarm annunciator and fire detecting zones shall be as direct as possible, and shall avoid, where possible, staterooms, lockers, and other enclosed spaces where this cable could be damaged by a localized fire or by other causes.

113.10–5(d) Conductors for several fire detecting zones may be run in a multi-conductor cable, but a conductor shall not be used as a common return from two or more zones.

113.10–5(e) Connection boxes containing conductors to more than one fire detecting zone shall be of watertight construction and the cable entrances shall be made tight by means of terminal or stuffing tubes.

113.10–5(f) Connection boxes for fire detector stations, manual alarm stations, test stations, or other boxes containing the conductors of a single fire detecting zone may be of nonwatertight construction, if installed in a dry location.

113.10–90 Equipment and installations on vessels contracted for prior to November 19, 1952

113.10–90(a) Existing arrangements, materials, and facilities previously approved, but not meeting the applicable specifications or requirements set forth in Section 113.10–5, may be continued in service so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and minor alterations may be made to the same standards as the original installation: *Provided*, That, in no case, will a greater departure from the standards of Section 113.10–5 be permitted than presently exist. All new installations or major replacements shall meet the applicable specifications or requirements.

113.10–90(b) All conductors shall conform to specifications for interior communication cable contained in the marine rules as adopted by the Institute of Electrical and Electronic Engineers as regards construction, size, leading, armoring, protection, support, and details of installation, with the following exceptions:

113.10–90(b)(1) All conductors shall be lead sheathed to protect against moisture and conductors exposed to mechanical injury shall be leaded and armored.

113.10–90(b)(2) Lead-sheathed conductors may be used for voltages of 60 volts or less.

113.10–90(b)(3) In single-wire, closed-circuit systems (series) approved metallic sheathed wire shall be used in connecting thermostats in each thermostat zone, but approved multiconductor cable may be used to connect the several individual zones to the annunciator panel.

113.15 MANUAL FIRE ALARM SYSTEMS

113.15–1 Application

113.15–1(a) Where an electric manual fire alarm system is installed, the provisions of this subpart, with the exception of Section 113.15–90, shall apply to all installations contracted for on or after November 19, 1952. Installations contracted for prior to November 19, 1952, shall meet the requirements of Section 113.15–90.

113.15–1(b) For the vessels on which a manual fire alarm system is required, see Part 76 of Subchapter H (Passenger Vessels) of this chapter.

113.15–5 General requirements

113.15–5(a) Manual fire alarm annunciator, power supply, manual stations, and vibrating bells shall be of a type approved by the Commandant. Systems installed on vessels contracted for on or after November 19, 1959, shall meet the requirements of Subpart 161.002 of Subchapter Q (Specifications) of this chapter.

113.15–5(b) All electric cables installed in conjunction with manual fire alarm systems shall be either leaded and armored, impervious sheathed and armored or mineral insulated metal sheathed.

113.15–5(c) Cable runs between the annunciator and fire alarm zones shall be as direct as possible, and shall avoid, where possible, staterooms, lockers, and other enclosed spaces where the cable could be damaged by a localized fire or by other causes.

113.15–5(d) Conductors for several fire alarm zones may be run in a multiconductor cable, but a conductor shall not be used as a common return from two or more zones.

113.15–5(e) Connection boxes containing conductors to more than one fire alarm zone shall be of watertight construction and the cable entrances shall be made tight by means of terminal or stuffing tubes.

113.15–5(f) Connection boxes for manual stations, or other boxes containing the conductors of a single fire alarm zone, may be of nonwatertight construction if installed in a dry location.

113.15–90 Equipment and installations on vessels contracted for prior to November 19, 1952

113.15–90(a) Existing arrangements, materials, and facilities previously approved, but not meeting the applicable specifications or requirements set forth in Section 113.15–5, may be continued in service so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and minor alterations may be made to the same standards as the original installations: *Provided*, That, in no case, will a greater departure from the standards of Section 113.15–5 be permitted than presently exist. All new installations or major replacements shall meet the applicable specifications or requirements.

113.15–90(b) All conductors shall conform to specifications for interior communication cable contained in the marine rules as adopted by the Institute of Electrical and Electronic Engineers as regards construction, size, leading, armoring, protection, support and details of installation, with the following exceptions:

113.15–90(b)(1) All conductors shall be lead sheathed to protect against moisture and conductors exposed to mechanical injury shall be leaded and armored.

113.15–90(b)(2) Lead-sheathed conductors may be used for voltages of 60 volts or less.

113.15–90(b)(3) In single-wire, closed-circuit systems (series) approved metallic sheathed wire shall be used in connecting thermostats in each thermostat zone, but approved multi-conductor cable may be used to connect the several individual zones to the annunciator panel.

113.20 AUTOMATIC SPRINKLER SYSTEMS

113.20–1 Application

113.20–1(a) When an automatic sprinkler system is installed, the provisions of this subpart, with the exception of Section 113.20–90, shall apply to all installations contracted for on or after November 19, 1952. Installations contracted for prior to November 19, 1952, shall meet the requirements of Section 113.20–90.

113.20–5 General requirements

113.20–5(a) The general requirements for automatic sprinkler systems are contained in Subpart 76.25 of Supchapter H (Passenger Vessels) of this chapter.

113.20–5(b) The sprinkler alarm system, including annunciator, power supply, alarm switches, and bells shall be of an approved type.

113.20–5(c) All electric cable employed in a sprinkler alarm system shall be either leaded and armored, impervious sheathed and armored or mineral insulated metal sheathed.

113.20–5(d) All connection boxes, alarm switches, pressure switches, or level switches, etc., employed in the system shall be of watertight construction.

113.20–90 Equipment and installations on vessels contracted for prior to November 19, 1952

113.20–90(a) Existing arrangements, materials, and facilities previously approved, but not meeting the applicable specifications or requirements set forth in Section 113.20–5, may be continued in service so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and minor alterations may be made to the same standards as the original installation: *Provided*, That, in no case, will a greater departure from the standards of Section 113.20–5 be permitted than presently exist. All new installations or major replacements shall meet the applicable specifications or requirements.

113.20–90(b) All conductors shall conform to specifications for interior communication cable contained in the marine rules as adopted by the Institute of Electrical and Electronic Engineers as regards construction, size, leading, armoring, protection, support, and details of installation, with the following exceptions:

113.20–90(b)(1) All conductors shall be lead-sheathed to protect against moisture and conductors exposed to mechanical injury shall be leaded and armored.

113.20–90(b)(2) Lead-sheathed conductors may be used for voltages of 60 volts or less.

113.20–90(b)(3) In single-wire, closed-circuit systems (series) approved metallic sheathed wire shall be used in connecting thermostats in each thermostat zone, but approved multi-conductor cable may be used to connect the several individual zones to the annunciator panel.

113.20–90(c) Where a motor-driven sprinkler pump is installed, it shall be capable of being operated from the emergency electrical circuit in case of failure of the main power.

113.25 GENERAL ALARM SYSTEMS

113.25–1 Application

113.25–1(a) The provisions of this subpart, with the exception of Sections 113.25–25 and 113.25–90, shall apply to all manned vessels of over 100 gross tons, except barges, scows, and similar vessels, contracted for on or after November 19, 1952.

113.25–1(b) The provisions of Section 113.25–25 shall apply to all manned ocean and coastwise barges of over 100 gross tons, where the crew is divided into watches for the purpose of steering, contracted for on or after November 19, 1952.

113.25–1(c) The provisions of Section 113.25–30 shall apply to all barges of 300 gross tons and over contracted for on or after November 19, 1958, with sleeping accommodations for more than 6 persons.

113.25–1(d) The provisions of Section 113.25–90 shall apply to all manned vessels of over 100 gross tons, except barges, scows, and similar vessels, contracted for prior to November 19, 1952.

113.25–5 Operation

113.25–5(a) The general alarm system shall consist of electric vibrating bells located throughout passengers' and crew's quarters, machinery spaces, and work spaces, and so located as to warn all occupants in an emergency.

113.25–5(b) The general alarm system shall be operated by means of a manually operated contact maker located in the wheelhouse. On tankships the general alarm system shall also be controlled by means of a manually operated contact maker located in an accessible location in the deck officers' quarters and in the engineroom. On vessels other than tank vessels one additional contact maker may be installed in an accessible location other than the wheelhouse. Except for those installed in the wheelhouse, all contact makers shall be protected against tampering by means of an enclosure provided with a breakable transparent window.

113.25–5(c) On vessels on which an emergency squad is organized and on vessels having a manual fire alarm system, a second manually operated contact maker shall be located in the wheelhouse and so connected as to operate only the general alarm bells located in crew's quarters and machinery spaces.

113.25–10 General requirements

113.25–10(a) *Power supply.*

113.25–10(a)(1) The power supply for the general alarm system shall be a storage battery located above the bulkhead deck or above the freeboard deck, whichever is the higher, and in a protected area outside the machinery casing.

113.25–10(a)(2) The nominal potential of the general alarm system shall be not less than 6 volts and not more than 120 volts.

113.25–10(a)(3) The general alarm system supply shall be one of the following types:

113.25–10(a)(3)(i) One storage battery, used for no other purpose, in combination with an automatic charging panel that will maintain the battery in a fully charged condition at all times except immediately following a discharge. The storage battery shall have sufficient capacity to supply the general alarm system continuously for a period of at least 8 hours without being recharged;

★113.25–10(a)(3)(ii) Duplicate storage batteries so connected, in combination with a manual two-position transfer switch (having no OFF position), that one battery will be charged while the other battery is available for furnishing power to the system. Control, indicator, and alarm loads may be supplied from these batteries. Each of the two storage batteries shall have sufficient capacity to supply the general alarm system continuously for a period of at least 4 hours and to supply all other connected loads at maximum expected demand for a period of at least 8 hours without being recharged;

113.25–10(a)(3)(iii) A circuit connected to the temporary emergency bus of an emergency switchboard as provided for by Paragraph 112.15–1(i) of this subchapter; or

113.25–10(a)(3)(iv) A circuit from and interior communication switchboard, the interior communication switchboard being supplied by duplicate storage batteries so connected, in combination with a manual two-position transfer switch (having no OFF position), that one battery will be charged while the other battery is available for furnishing power to the switchboard. The interior communication batteries shall each be of sufficient capacity to supply without recharging the general alarm system continuously for a period of 4 hours and to supply all other connected loads at maximum expected demand for a period of at least 8 hours.

113.25–10(a)(4) When the general alarm system is the only load supplied by the general alarm system battery or batteries, the battery or batteries shall be protected against overcurrent by enclosed fused switches or circuit breakers, having provisions for locking to prevent either unauthorized operation of the switch or circuit breaker or unauthorized tampering with the fuses. The fused switch or circuit breaker shall be located outside of, but adjacent to, the battery room or battery locker, and the capacity of the fuses or circuit breaker shall be not less than 200 percent of the connected load.

★113.25–10(a)(5) When the general alarm system is supplied from an emergency or interior communication switchboard, or when the duplicate general alarm batteries supply other loads as permitted by subdivision (3)(ii) of this paragraph, the fused switch or circuit breaker supplying the general alarm system shall have provisions for locking to prevent unauthorized operation of the switch or circuit breaker and unauthorized tampering with the fuses.

113.25–10(b) *Distribution of general alarm system feeders and branch circuits.*

113.25–10(b)(1) A feeder distribution panel shall be provided to divide the system into the required number of zone feeders. The distribution panel shall afford overcurrent protection for each zone feeder, but no disconnect switches shall be provided. The distribution panel shall be located above the bulkhead deck or above the freeboard deck, whichever is the higher, and outside the machinery casing.

113.25–10(b)(2) At least one feeder shall be provided for each vertical fire zone in which general alarm bells are located.

113.25–10(b)(3) One or more branch circuit distribution panels shall be provided for each zone feeder with at least one fused branch circuit for each deck level. The distribution panel shall be located above the bulkhead deck or above the freeboard deck, whichever is the higher, in the zone served, and no disconnect switches shall be provided for the branch circuits.

113.25–10(b)(4) No more than five general alarm bells shall be connected to one branch circuit, and a branch circuit shall not supply bells on more than one deck level.

113.25–10(b)(5) On vessels not divided into fire zones by main vertical fire bulkheads, the vessel shall be divided into vertical zones not exceeding 150 feet in length and a general alarm feeder provided for each such zone in which general alarm bells are required.

113.25–10(b)(6) On vessels where accommodation spaces are located only at the extremities of the vessels, other arrangements of feeders and branch circuits will be considered.

113.25–10(c) *Location of general alarm bells.*

113.25–10(c)(1) General alarm bells shall be so distributed throughout passengers' and crew's quarters in such number and in such a manner as to obtain in each room with the door closed either:

113.25–10(c)(1)(i) A sound level of not less than 75 decibels; or

113.25–10(c)(1)(ii) A sound level of 6 decibels above the ground noise level existing when the vessel is underway in moderate weather, whichever is the higher.

113.25–10(c)(2) General alarm bells shall be so distributed throughout public spaces, work spaces, and machinery spaces in such number and in such a manner as to warn all occupants in an emergency.

113.25–15 Detail requirements

113.25–15(a) *Storage batteries.*

113.25–15(a)(1) Storage batteries shall comply with the requirements of Subpart 112.55 of this subchapter.

113.25–15(a)(2) At the end of the discharge period specified by paragraph 113.25–10(a), the battery potential shall be not less than 80 percent of nominal potential under load.

113.25–15(b) *Contact maker.*

113.25–15(b)(1) The contact maker shall be a normally open circuit spring-return-to-normal type of enclosed watertight switch.

113.25–15(b)(2) The contact maker shall be designed to close its contacts when a substantial operating handle is rotated in a clockwise direction through an arc of approximately 60 degrees.

113.25–15(b)(3) The switch handle shall have means provided for locking in the ON position by means of a spring-loaded locking pin.

113.25–15(b)(4) The OFF and ON positions of the operating handle shall be indicated by means of prominently raised letters.

113.25–15(b)(5) The contact maker shall be provided with mechanical stops to limit the rotation of the operating handle.

113.25–15(b)(6) The contact maker shall have an inductive load rating not less than the connected load. On large vessels, consideration will be given to the use of auxiliary devices to interrupt the load current.

113.25–15(c) *Vibrating bells.*

113.25–15(c)(1) Vibrating bells installed in conjunction with a general alarm system shall be of a type approved by the Commandant.

113.25–15(c)(2) General alarm system vibrating bells shall produce a signal of a tone distinct from that of any other bell signals on the vessel.

113.25–15(d) *Electric cable and distribution fittings.*

113.25–15(d)(1) All cable installed in conjunction with general alarm systems shall be either leaded and armored, impervious sheathed and armored or mineral insulated metal sheathed.

113.25–15(d)(2) Cable entrances to all bells and distribution fittings shall be made watertight by means of terminal or stuffing tubes.

113.25–15(d)(3) Distribution panels shall be of watertight construction and shall be of a type requiring the use of a tool to gain entrance to the box.

113.25–15 (d)(4) All fuses employed in a general alarm system shall be 250-volt National Electric Code standard, nonrenewable cartridge fuses bearing the approval label of a recognized testing organization.

113.25–15(d)(5) General alarm system fuse capacities shall be selected to obtain as wide a differential as possible between branch circuit fuses and feeder fuses. The capacity of a feeder fuse shall be approximately 200 percent of the load supplied, and the capacity of a branch circuit fuse shall not exceed 50 percent of the capacity of the feeder fuse.

113.25–20 Marking of equipment

113.25–20(a) Each general alarm system fused switch and distribution panel shall be provided with a permanent nameplate on the outside of the door describing its function. The rating of fuses shall also be indicated for fused switches.

113.25–20(b) The general alarm contact maker shall be marked with lettering on a corrosion-resistant plate or with a sign in red letters on a suitable background "GENERAL ALARM".

113.25–20(c) A contact maker to operate only the general alarm bells in crew quarters, machinery and work spaces shall be marked as described in Paragraph (b) of this Section except with the words "CREW ALARM".

113.25–20(d) General alarm bells shall be marked in not less than ½-inch red letters "GENERAL ALARM—WHEN BELL RINGS GO TO YOUR STATION".

113.25–20(e) Each general alarm system distribution panel shall be provided with a directory attached to the inside of the cover giving the designation of each circuit, the area supplied by each circuit, and the rating of all circuit fuses.

113.25–25 General alarm system for manned ocean and coastwise barges

113.25–25(a) Each manned ocean and coastwise barge of over 100 gross tons, where the crew is divided into watches for the purpose of steering the vessel, shall be provided with a suitable alarm bell installation.

113.25–30 General alarm system for barges of 300 gross tons and over with sleeping accommodations for more than 6 persons

113.25–30(a) Barges of 300 gross tons and over with sleeping accommodations for more than 6 persons shall be provided with a suitable alarm bell installation.

113.25–90 General alarm system for existing vessels

113.25–90(a) All vessels of over 100 gross tons the construction of which was begun on or after September 1, 1943, but prior to November 19, 1952, shall have all sleeping accommodations, public spaces, and machinery spaces equipped with a sufficient number of alarm bells so located as to warn all occupants. The system shall operate from a continuous source of electric energy capable of supplying the system for a period of at least 8 hours without being dependent upon the main, auxiliary or emergency generating plants. Each bell shall produce a signal of a tone distinct from that of other bell signals in the vicinity and shall be independently fused with each of these fuses located above the bulkhead deck. The bells shall be controlled by a manually operated contact maker located in the pilothouse, or, if specific approval is given by the Commandant, in the fire control station. The characteristics of the contact maker shall be such that it possesses:

113.25–90(a)(1) Positive contact.

113.25–90(a)(2) Watertightness (when located in open spaces subject to weather).

113.25–90(a)(3) Means whereby its electrically open or closed position can be determined by sense of touch.

113.25–90(a)(4) Means to effect a make-and-break circuit for signaling.

113.25–90(a)(5) Self-maintaining contacts.

113.25–90(b) All vessels of over 100 gross tons the construction of which was begun prior to September 1, 1943, shall have all sleeping accommodations equipped with a sufficient number of alarm bells so located as to warn all the occupants. The alarm bells, if electric, shall be operated from an open switch from the pilothouse or bridge. The bells shall be of such size, character, and construction as to provide an alarm throughout the spaces for which they are provided.

113.25–90(c) Existing arrangements, materials, and equipment previously approved shall be considered satisfactory so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and minor alterations may be made to the same standard as the original installation. All new installations or major replacements shall meet the applicable specifications or requirements for new vessels.

113.30 SOUND POWERED TELEPHONE AND VOICE TUBE SYSTEMS

113.30–1 Application

113.30–1(a) The provisions of this subpart, with the exception of Section 113.30–90, shall apply to all self-propelled vessels contracted for on or after November 19, 1952. Vessels contracted for prior to November 19, 1952, shall meet the requirements of Section 113.30–90.

113.30–5 General requirements

113.30–5(a) Vessels shall be provided with an efficient means of communication between each of the following:

113.30–5(a)(1) Wheelhouse.

113.30–5(a)(2) Engineroom.

113.30–5(a)(3) Steering gear room, if located outside of engineroom.

113.30–5(a)(4) After steering station, if required.

113.30–5(b) Vessels equipped with a gyro-compass system shall be provided with an efficient means of communication between the master gyro-compass and the wheelhouse repeater compass. Whenever the master gyro-compass is located within any compartment adjoining or opening into the wheelhouse, the master gyro-compass shall be considered as being located in the wheelhouse and no communication therewith is required.

113.30–5(c) Vessels equipped with a radar plan position indicator installation remotely located from the wheelhouse shall be provided with an efficient means of communication between the wheelhouse and the radar plan position indicator.

113.30–5(d) Where emergency squad equipment is stowed in lockers or spaces remote from the wheelhouse, an efficient means of communication shall be provided between the wheelhouse and the emergency squad equipment stowage space or spaces.

113.30–5(e) Communication to radio and radio direction-finder shall comply with the requirements of this paragraph. The term "radio installation" shall be construed to mean either the radiotelegraph installation or, where only a radiotelephone is installed, the radiotelephone installation.

113.30–5(e)(1) Vessels equipped with a radio installation shall be provided with an efficient means of communication between the radio room and the wheelhouse and one other place, if any, from which the vessel may be navigated under normal conditions, as opposed to other such places established solely for emergency functions, or places used solely for docking or maneuvering, or places used occasionally while navigating the vessel in close quarters. As used in this paragraph only a location which includes the necessary apparatus to steer the vessel, give engine orders, and control the whistle will be considered a place from which the vessel may be navigated.

113.30–5(e)(1)(i) Where the operating position of the emergency radio installation is not located in the compartment normally used for operating the main radio installation, and efficient means of communication shall be provided between the emergency radio room and the wheelhouse and one other place, if any, from which the vessel may be navigated under normal conditions, as opposed to other such places established solely for emergency functions, or places used solely for docking or maneuvering, or places used occasionally while navigating the vessel in close quarters.

113.30–5(e)(2) Vessels equipped with radio direction-finding apparatus shall be provided with an efficient means of communication between the wheelhouse and the direction-finding apparatus.

113.30–5(e)(2)(i) Whenever the direction-finder receiver is located on the navigating bridge of a ship or within any compartment adjoining or opening onto the wheelhouse of a ship, the direction-finding apparatus shall be considered as being located in the wheelhouse, and no communication is required.

113.30–5(e)(3) The communication systems required by this paragraph shall be independent of any other system on the ship, and the location of the termination of these systems shall be subject to approval by the Federal Communications Commission.

113.30–5(f) Vessels equipped with smoke detecting systems contracted for on or after January 1, 1962, where detecting cabinets are not located in the pilothouse shall be provided with an efficient means of direct communication between the pilothouse and the stations where the detecting cabinets are located.

★113.30–5(g) An efficient means of communication shall be provided between the wheelhouse and the bow or forward lookout station. This communication need not be by means of sound powered telephone or voice tube if other suitable means is provided or if the vessel configuration is such that direct voice communication between the wheelhouse and bow or forward lookout station is effective. When a sound powered telephone is installed, the requirements of Paragraph 113.30–20(b) are applicable.

113.30–10. Voice tubes, general requirements

113.30–10(a) Voice tubes may be employed to comply with the requirements of this subpart where the required length of voice tube as installed will not exceed 125 feet.

113.30–10(b) Where the length of voice tube as installed is not over 75 feet, the tube used shall be at least 2 inches outside diameter.

113.30–10(c) Where the length of voice tube as installed is over 75 feet and not over 125 feet, the tube shall be at least 2½ inches outside diameter.

113.30–10(d) Sound powered telephone equipment may be installed in all cases where voice tube communication is permitted.

113.30–15 Voice tubes, detail requirements

113.30–15(a) Voice tubes and voice tube fittings shall be constructed of brass or other corrosion-resistant material having a wall thickness of approximately 0.042 inch.

113.30–15(b) Voice tubing shall be run as direct as possible, and the cross-section of the tube shall be constant throughout the run. Any constriction in the tube such as a dent; reducer coupling, sharp elbow, T connection, or any flat surface shall be avoided. Flexible tubes or bends shall be used in place of fittings wherever possible. Joints in tubing shall be protected by a close-fitting sleeve and the joint soldered or filled with white lead.

113.30–15(c) Voice tubes shall be supported at least every 8 feet on straight runs and at bends as required.

113.30–15(d) Voice tubes shall be protected where liable to injury and shall not be run in bunkers, cargo spaces, or through machinery spaces unless unavoidable.

113.30–15(e) Voice tubes shall be provided with drain plugs at the bottom of each vertical run and at all other places where water can collect.

113.30–15(f) Each voice tube shall be terminated at each end by a suitable mouthpiece with a whistle indicator. Watertight mouthpieces shall be used in locations exposed to the weather.

113.30–15(g) All voice tubes shall be provided with designating nameplates.

113.30–20 Sound powered telephone system, general requirements

113.30–20(a) Where a voice tube installation would require a length of the tube exceeding 125 feet or where for other reasons efficient communication cannot be obtained by a voice tube installation, approved sound powered telephone equipment shall be installed as the means of communication required by this subpart.

★113.30–20(b) The telephone stations listed in Paragraph 113.30–5 (a) through (d), (f), and (g) may be installed on the same circuit. However, when included on the same circuit with other required stations, the bow or forward lookout telephone must be provided with a wheelhouse cut-out switch if the telephone is located in the weather. Other stations which are desirable for the operation of the vessel, such as captain's and chief engineer's office and stateroom, emergency power room, CO_2 control room, fire pumproom, etc., will be considered for inclusion on this circuit.

113.30–20(c) Sound powered telephone systems may, in all cases, be installed in lieu of voice tube systems.

★113.30–20(d) Except as provided in paragraph (b) of this section, telephone stations not specifically required by this subpart which are located in the weather shall not be included on a telephone circuit which includes any of the required telephone stations.

★113.30–20(e) Jack boxes or headsets shall not be utilized on a telephone installation that includes any of the stations required by this subpart.

113.30–25 Sound powered telephone system, detail requirements

★113.30–25(a) Sound powered telephone equipment used on a telephone circuit that includes any of the stations required by this subpart shall be of a type approved by the Commandant.

113.30–25(b) Sound powered telephone stations installed in locations exposed to the weather shall be of watertight construction, and the audible signal shall be mounted external to the station enclosure.

113.30–25(c) Sound powered telephone stations installed in wheelhouse or machinery spaces shall be of at least drip-proof construction.

113.30–25(d) In noisy locations, a telephone booth or other suitable auxiliary equipment shall be provided if necessary in order that a telephone conversation can be carried on while the vessel is being navigated.

113.30–25(e) In noisy locations where the magneto-operated telephone station sound signal cannot be heard throughout the space, the sound signal shall be supplemented by an additional sound signal energized from the vessel's electrical system and magneto actuated. This supplementary sound signal shall not be combined with any other signal or alarm system, such as an engineers' signal and alarm panel.

113.30–25(f) When two or more telephone stations are located in close proximity to each other, a suitable means shall be provided to indicate the station called.

113.30–25(g) The sound powered telephone talking circuit shall be electrically independent of the calling circuits. A short circuit, open circuit, or ground on either side of the calling circuit shall not affect the talking circuit in any way. All circuits shall be insulated from ground.

113.30–25(h) Sound powered telephone circuits shall be run in leaded and armored, impervious sheathed and armored or mineral-insulated metal sheathed cable. All connection boxes employed shall be watertight.

★113.30–25(i) Telephone cables shall be run as close to the fore and aft centerline of the vessel as is practicable and through runs of cable should avoid such spaces as machinery room and galleys.

113.30–90 Sound powered telephone and voice tube systems for existing vessels

113.30–90(a) Vessels contracted for prior to November 19, 1952, shall meet the requirements contained in this section.

113.30–90(b) Except as otherwise required by paragraph (d) of this section, existing arrangements, materials, and facilities previously approved will be considered satisfactory so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and minor alterations may be made to the same standard as the original installation.

113.30–90(c) All new installations or major replacements shall meet the applicable specifications or requirements for new vessels.

113.35 ENGINE ORDER TELEGRAPH SYSTEMS

113.35–1 Application

113.35–1(a) The provisions of this subpart, with the exception of Section 113.35–90, shall apply to all self-propelled vessels contracted for on or after November 19, 1952. Installations contracted for prior to November 19, 1952, shall meet the requirements of Section 113.35–90.

113.35–5 General requirements

113.35–5(a) All vessels, except as otherwise provided for in this section, shall have installed an efficient means for transmitting engine orders from the wheelhouse to the engineroom and of transmitting acknowledgment of engine orders from the engineroom to the wheelhouse.

113.35–5(a)(1) On vessels with more than one propulsion engine, this efficient means of transmitting engine orders shall be provided for each engine.

113.35–5(a)(2) On double-ended vessels with two wheelhouses, this efficient means of transmitting engine orders shall be provided between the engineroom and each wheelhouse.

113.35–5(a)(3) On vessels provided with a means of steering from the top of the wheelhouse as well as from the wheelhouse, this efficient means of transmitting engine orders shall also be provided between the engineroom and the top of the wheelhouse.

113.35–5(b) The efficient means of transmitting engine orders may be of the engine gong and sound tube type, the mechanical engine order telegraph type, the electric engine order telegraph type, or other types as may be approved.

113.35–5(c) Small vessels on which the propulsion plant is controlled entirely from the wheelhouse with no means of normal engine control from the engineroom, need not be provided with an engine order telegraph system between the wheelhouse and the engineroom.

113.35–10 Engine gong systems, general requirements

113.35–10(a) An engine gong system shall consist of pull handles located in the wheelhouse mechanically connected by wires and chains to gongs located in the engineroom.

113.35–10(a)(1) A sound tube of proper size shall be run between the wheelhouse and the engineroom and so arranged as to return the sound of the gong signals to the wheelhouse.

113.35–10(a)(2) A speaking tube or other device for the purpose of conversation between the wheelhouse and the engineroom shall also be provided.

113.35–10(b) The sound tube and the speaking tube shall comply with the requirements of Section 113.30–15 except that the sound tube shall be terminated by a flared sounder in lieu of whistle mouthpieces and the sound tube size shall be not less than 2½ inches outside diameter.

113.35–10(c) The engineroom gong and the termination of the sound tube and the speaking tube in the engineroom shall be at the engine control station.

113.35–10(d) The gong pull installation shall comply with the applicable requirements of Section 113.35–25.

113.35–15 Engine gong systems, application

113.35–15(a) Engine gong systems shall not be employed on vessels where the length of sound tube as installed will exceed 40 feet.

113.35–20 Mechanical engine order telegraph systems, general requirements

113.35–20(a) Mechanical engine order telegraph systems shall consist of transmitters and indicators mechanically connected to each other by means of chains and wires.

113.35–20(b) Transmitters and indicators shall be provided with dials divided into sectors or divisions with the various engine orders engraved thereon.

113.35–20(c) Rotation of the transmitter handle and its associated pointer shall drive the indicator pointer in synchronism. The indicator pointer, always having the same angular position as the transmitter handle and its associated pointer, shall point to the order corresponding to the order on the transmitter.

113.35–20(d) The engineroom indicator shall be equipped with a reply handle and associated pointer driving a reply pointer in the wheelhouse transmitter for acknowledgement of orders.

113.35–20(e) Each transmitter and each indicator shall be provided with an audible signal device to indicate, in the case of an indicator, the receipt of an order and, in the case of a transmitter, the acknowledgement of an order. The audible signal device shall not be dependent upon any source of power for operation other than that of the movement of the transmitter or indicator handle.

113.35–20(f) The dials of transmitter instruments shall be illuminated in such a manner as not to interfere with navigating the vessel at night.

113.35–20(g) Transmitter and indicator operating handles shall be of substantial size so that engine orders may be determined from a distance.

113.35–25 Mechanical engine order telegraph systems, detail requirements

113.35–25(a) Telegraph wire shall be No. 10 Stubs Gage (0.134 inch diameter) soft brass wire and shall be stretched approximately 20 percent before installation.

113.35–25(b) Pulleys shall be provided wherever a bend in the run of the telegraph wire is made, and at each pulley sheave a length of brass telegraph chain shall be employed.

113.35–25(c) Pulleys shall be in line with the wire and chain.

113.35–25(d) Turnbuckles shall be provided in each lead at each instrument to adjust the handles and pointers to the central position of the order, and shall be provided at other locations throughout the system as necessary to take up slack in the lead wires and to center the chains at the pulleys.

113.35–25(e) Where telegraph leads pass through watertight decks or bulkheads, stuffing tubes shall be employed.

113.35–25(f) On long horizontal runs, the telegraph wire shall be supported on roller bearers at approximately every 5 feet of run. When telegraph leads are run behind sheathing or when subject to mechanical damage, the leads shall be run "in pipe."

113.35–25(g) All fittings used in telegraph installations shall be constructed of brass, bronze, or other corrosion-resistant materials.

113.35–25(h) Positive locking devices, such as keys, shall be used in securing handles and similar parts to their associated shafts to ensure continuous operation of the shaft in response to movement of the handle.

113.35–25(i) Transmitter dials shall be arranged with the "STOP" order at the top vertical position of the operating handle. On ahead orders the operating handle shall be moved toward the bow of the vessel and on astern orders the operating handle shall be moved toward the stern of the vessel.

113.35–25(j) Indicator dials shall be arranged as specified for transmitter dials except that the "STOP" order shall be at the bottom vertical position of the reply handle.

113.35–25(j)(1) Indicator dials on double-ended vessels shall not be marked with the designations "AHEAD" and "ASTERN", but the reply handle and indicator arrow shall point in the direction in which it is desired that the engine operate.

113.35–30 Mechanical engine order telegraph systems, operation

113.35–30(a) Where more than one transmitter, located in the wheelhouse, the wings of the navigating bridge, and/or the top of the wheelhouse, operate a common indicator in the engineroom, all the transmitters shall be mechanically interlocked and operate in synchronism. The method of mechanical interlocking shall be such that a failure of the transmission wire or chain at any transmitter located topside will not interrupt or disable other topside transmitters.

113.35–35 Mechanical engine order telegraph systems, application

113.35–35(a) Mechanical engine order telegraph systems may be installed on all vessels to provide the communication required by this subpart where the length of cables or other mechanical limitations will not prevent the efficient operation of the system.

113.35–40 Electric engine order telegraph systems, general requirements

113.35–40(a) Electric engine order telegraph systems shall consist of transmitters and indicators electrically connected to each other.

113.35–40(b) Transmitters and indicators shall be provided with dials divided into sectors or divisions with the various engine orders engraved thereon.

113.35–40(c) Rotation of the transmitter handle and its associated pointer shall drive the indicator pointer in synchronism. The indicator pointer, always having the same angular position as the transmitter handle, shall point to the order corresponding to the order on the transmitter.

113.35–40(d) For acknowledgment of orders, the engineroom indicator shall be equipped with a handle and generator actuating a motor and pointer on the transmitter, similar to the facilities provided for transmitting orders.

113.35–40(e) Audible signals associated with the system shall consist of a vibrating bell at each instrument. The vibrating bell at both transmitter and indicator shall ring continuously at all times when the transmitter arrow and the reply arrow do not point to the same order.

113.35–40(f) The dials of transmitter instruments shall be illuminated in such a manner as not to interfere with navigating the vessel at night.

113.35–40(g) Transmitter and indicator operating handles shall be of substantial size so that the engine order may be determined from a distance.

113.35–45 Electric engine order telegraph systems, detail requirements

113.35–45(a) Telegraph instruments shall form watertight enclosures for the electrical components.

113.35–45(b) Materials used in the construction of telegraph instruments shall be corrosion-resistant.

113.35–45(c) Transmitter dials shall be in accordance with Paragraph 113.35–25(i).

Indicator dials shall be in accordance with Paragraph 113.35–25(j) except that the "STOP" order may be at the bottom or top vertical position of the reply handle to suit bulkhead or pedestal mounted instruments, respectively.

113.35–45(d) Electric cable used in conjunction with electric telegraphs shall be leaded and armored, impervious sheathed and armored or mineral-insulated metal sheathed and all connection boxes shall be of watertight construction.

113.35–45(e) Each system shall be provided with an alarm device which automatically sounds audibly and indicates visually in the event of loss of potential to the system.

113.35–45(e)(1) This alarm device shall be located in the wheelhouse.

113.35–45(e)(2) Means shall be provided to silence the audible signal.

113.35–45(e)(3) Where the supervisory power supply is a dry cell battery or some other low capacity source, there shall be no electric drain on the supervisory power supply after the audible signal has been silenced; the visible indication may be extinguished to effect this. Upon reestablishment of potential to the telegraph system, the audible signal shall sound again until the alarm circuit is returned to normal unless restoration of this alarm circuit is effected automatically.

113.35–50 Electric engine order telegraph system, operation

113.35–50(a) Where more than one transmitter, located in the wheelhouse, the wings of the navigating bridge, and/or the top of the wheelhouse, operate a common indicator in the engineroom, either the transmitters shall operate in synchronism in accordance with paragraph (b) of this section, or the transmitters shall operate under the control of a transmitter transfer control in accordance with paragraph (c) of this section.

113.35–50(b) All transmitter handles and pointers and all reply pointers shall operate in synchronism. Where the transmitters are mechanically interlocked to effect synchronous operation, the requirements of Paragraph 113.35–30(a) shall be met.

113.35–50(c) All transmitters shall operate under the control of a transmitter transfer control so that movement of any one transmitter handle automatically connects that instrument electrically to the engineroom indicator and simultaneously disconnects electrically all other transmitters. The reply pointers of all transmitters shall operate in synchronism at all times.

113.35–55 Electric engine order telegraph systems, application

113.35–55(a) Electric engine order telegraph systems may be installed on all vessels to provide the communication required by this subpart, except that passenger vessels of 20,000 gross tons or over equipped with an electric engine order telegraph system shall be provided with a standby system, either electrical or mechanical.

113.35–90 Engine order telegraph systems for existing vessels

113.35–90(a) The engine order telegraph installations on vessels contracted for prior to November 19, 1952, shall meet the requirements in this section.

113.35–90(b) Existing arrangements, materials, and facilities previously approved will be considered satisfactory so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and minor alterations may be made to the same standard as the original installation.

113.35–90(c) All new installations or major replacements shall meet the applicable specifications or requirements for new vessels.

113.40 RUDDER ANGLE INDICATOR SYSTEMS

113.40–1 Application

113.40–1(a) The provisions of this subpart, with the exception of Section 113.40–90 shall apply to all self-propelled vessels contracted for on or after November 19, 1952. Vessels contracted for prior to November 19, 1952, shall meet the requirements of Section 113.40–90.

113.40–5 General requirements

113.40–5(a) The exact position of the rudder, if power operated, shall be indicated at the principal steering station. When non-followup steering control is installed at the after steering station, a separate rudder angle indicator system shall be installed for that station. See Part 57 of Subchapter F (Marine Engineering) of this chapter.

113.40–10 Detail requirements

113.40–10(a) The rudder angle indicator system shall consist of a transmitter located at the rudder head and actuated by movement of the rudder, the angular movements of the rudder being transmitted to a remote indicator(s).

113.40–10(b) The indicator instrument shall consist of a fixed dial with angular positions of the rudder right and left of an amidship position indicated thereon. Indications of rudder angle shall be by means of a moving pointer.

113.40–10(b)(1) The movement of the indicator pointer shall be consistent with the movement of the steering wheel or control.

113.40–10(c) The indicator(s) shall be located in direct line of vision of the helmsman and shall be provided with dial illumination in such a manner as not to interfere with navigating the vessel at night.

113.40–10(d) The method of transmitting rudder movement between the transmitter and the indicator(s) may be either by self-synchronous generator and motor(s), by mechanical telegraphs, or by other equivalent means.

113.40–10(e) The electric rudder angle indicator system shall comply with the applicable requirements of Sections 113.35–40 and 113.35–45 (a) to (d), inclusive.

113.40–10(f) Mechanical methods of transmitting rudder angles shall be in accordance with approved installation drawings submitted for each installation.

113.40–90 Rudder angle indicator systems for existing vessels

113.40–90(a) Rudder angle indicator systems on vessels contracted for prior to November 19, 1952, shall meet the requirements in this section.

113.40–90(b) Existing arrangements, materials, and facilities previously approved will be considered satisfactory so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and minor alterations may be made to the same standard as the original installation.

113.40–90(c) All new installations or major replacements shall meet the applicable specifications or requirements for new vessels.

113.45 REFRIGERATED SPACES ALARM SYSTEMS

113.45–1 Application

113.45–1(a) The provisions of this subpart, with the exception of Section 113.45–90, shall apply to all vessels contracted for on or after November 19, 1952. The provisions of Section 113.45–90 shall apply to all vessels contracted for prior to November 19, 1952.

113.45–5 General requirements

113.45–5(a) Each refrigerated space accessible to ship's personnel during a voyage and which can be so locked from the outside that it cannot be opened from the inside, shall be fitted with an alarm system operated from within each refrigerated space.

113.45–5(b) The alarm system may be either a mechanical pull operating a jingle bell or an electrical pushbutton operating a vibrating bell or other audible device.

113.45–5(c) The mechanical pull or electrical pushbutton shall be located at the exit from the refrigerated compartment.

113.45–5(d) The audible signal shall be located where a person is regularly employed.

113.45–5(e) Where a common audible signal is provided for more than one lockable refrigerated compartment, an annunciator shall be provided to locate the compartment from which the signal was initiated.

113.45–90 Refrigerated spaces alarm systems on existing vessels

113.45–90(a) Refrigerated spaces alarm systems on vessels contracted for prior to November 19, 1952, shall meet the requirements in this section.

113.45–90(b) Existing arrangements, materials, and facilities previously approved will be considered satisfactory so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and minor alterations may be made to the same standard as the original installation.

113.45–90(c) All new installations or major replacements shall meet the applicable specifications or requirements for new vessels.

113.50 EMERGENCY LOUDSPEAKER SYSTEM

113.50–1 Application

113.50–1(a) The provisions of this subpart, with the exception of Section 113.50–90, shall apply to all ocean and coastwise passenger vessels contracted for on or after November 19, 1952. Ocean and coastwise vessels contracted for prior to November 19, 1952, shall meet the requirements of Section 113.50–90.

113.50–5 General requirements

113.50–5(a) All ocean and coastwise passenger vessels certificated to carry 500 or more persons, including officers and crew, and/or all passenger vessels whose lifeboats are stowed more than 100 feet from the navigating bridge, shall be equipped with an approved loudspeaker system which will enable an officer on the bridge to broadcast separately or collectively to the stations listed in this paragraph.

113.50–5(a)(1) Lifeboat stations, port.

113.50–5(a)(2) Lifeboat stations, starboard.

113.50–5(a)(3) Lifeboat embarkation stations, port.

113.50–5(a)(4) Lifeboat embarkation stations, starboard.

113.50–5(a)(5) Public spaces used for passenger assembly stations.

113.50–5(a)(6) Crew quarters.

113.50–5(b) The system shall be controlled from a single location on the navigating bridge.

113.50–5(c) Loudspeakers, as designated by the Commandant, at lifeboat and embarkation stations shall be arranged for two-way conversation with the navigating bridge.

113.50–5(d) The emergency loudspeaker system shall be of a type approved by the Commandant. Systems installed on vessels contracted for on or after November 19, 1958, shall meet the requirements of Subpart 161.004 of Subchapter Q (Specifications) of this chapter.

113.50–10 Power supply

113.50–10(a) The loudspeaker system shall be energized from the source of emergency lighting and power as required by Subpart 112.15 of this Subchapter.

113.50–10(b) Where the loudspeaker system requires a power supply of a character different from that available from the temporary source of emergency lighting and power, conversion equipment as required by Subpart 112.40 of this Subchapter shall be provided.

113.50–15 Location of loudspeakers and amplifiers

113.50–15(a) *General.*

113.50–15(a)(1) Loudspeakers shall be located with due regard to the intended service and to minimize as much as possible the effects of feedback and other interference.

113.50–15(a)(2) In general, loudspeakers on open decks shall be directed toward the after end of the vessel and outboard by an angle of approximately 15 degrees.

113.50–15(b) *Boat deck loudspeakers.*

113.50–15(b)(1) A loudspeaker shall be located at each lifeboat handling station. The axis of the loudspeaker shall be directed aft and outboard in such a manner that the sound level at the lifeboat handling station will be not less than the levels given in Table 113.50–15.

113.50–15(c) *Lifeboat embarkation and passenger assembly station loudspeakers.*

113.50–15(c)(1) Loudspeakers shall be distributed throughout the lifeboat embarkation deck and locations designated by the vessel's station bill for the assembly of passengers in an emergency, in such number as to provide an even distribution of sound at a level not less than that specified in Table 113.50–15. An even distribution of sound level is considered satisfied if the variation does not exceed plus or minus 3 decibels.

TABLE 113.50–15.—*Minimum sound level requirements for loudspeaker systems*

(all data given in decibels[1])

Location	Ground noise level minimum	Signal level		Voice level	
		Above ground noise	Total	Above ground noise	Total
Lifeboat stations	80	20	[2] 100	15	[2] 95
Embarkation deck and exterior passenger assembly points	80	20	[2] 100	15	[2] 95
Interior passenger assembly points	75	20	[2] 95	15	[2] 90
Crew quarters	60	18	[3] 78	12	[3] 72

[1] The zero decibel level shall be 0.0002 dyne per square centimeter.

[2] Measured at a distance of 10 feet from the loudspeaker and on the axis thereof.

[3] Measured in rooms with the doors to the passageways closed.

113.50–15(d) *Crew quarters loudspeakers.*

113.50–15(d)(1) Loudspeakers shall be distributed in passageways throughout crew quarters in such number as to provide a sound level not less than that specified in Table 113.50–15 in each room with the doors closed.

113.50–15(e) *Amplifier.*

113.50–15(e)(1) The emergency loudspeaker amplifier, if not located in the same enclosure with the control panel, shall be located in the wheelhouse or in a compartment adjoining or opening into the wheelhouse.

113.50–20 Distribution of cable runs

113.50–20(a) Cable runs to the different loudspeaker groups shall be as widely separated from each other as possible to limit the extent of damage to the system from a single casualty. In addition, the distribution shall be such that a casualty to the port or starboard supplies to loudspeakers on boat and embarkation decks will render not more than half of the loudspeakers in the group inoperative. This may be accomplished by feeding the loudspeakers of a particular group alternately from a port and starboard multiconductor cable.

113.50–20(b) Cable runs shall, where possible, be located in passageways and shall avoid staterooms, lockers, and other enclosed spaces.

113.50–25 Type of cable and equipment enclosures

113.50–25(a) All cable used in connection with the system shall be either leaded and armored, impervious sheathed and armored or mineral insulated metal sheathed.

113.50–25(b) All junction or connection boxes employed in the distribution system shall be of watertight construction.

113.50–30 Shipboard tests

113.50–30(a) The operation of the system shall be observed to determine that voice reproduction is of good quality and intelligibility of a high order.

113.50–30(b) Sound levels shall be measured with a sound level meter to demonstrate that the levels listed in Table 113.50–15 are met.

113.50–30(b)(1) Where the ground noise level with the vessel under way in moderate weather is in excess of the values listed in Table 113.50–15, the signal and voice levels shall be increased correspondingly so that the differential between ground noise level and the signal and voice levels shall be not less than the differential given in this Table.

113.50–30(c) It shall be demonstrated that grounding either conductor or "shorting" both conductors to any one lifeboat station loudspeaker or to an embarkation deck loudspeaker, will not reduce the output of any one of the remaining loudspeakers by more than 3 decibels.

113.50–35 Operation of emergency loudspeaker systems

113.50–35(a) The emergency loudspeaker system shall be used at the discretion of the master and shall function entirely independently of any public address or music distribution system.

113.50–35(b) The emergency loudspeaker system shall not be used for entertainment purposes.

113.50–35(c) The complete emergency loudspeaker system shall be given an operating test at least once every week. These tests shall be made by a licensed officer and the condition of the equipment entered in the vessel's log.

113.50–35(d) When a vessel is equipped with a public address or music distribution system, means shall be provided adjacent to the emergency loudspeaker system control panel to silence the public address or music distribution systems.

113.50–90 Emergency loudspeaker systems for existing vessels

113.50–90(a) *Existing vessels.* Emergency loudspeaker systems on ocean and coastwise passenger vessels contracted for prior to November 19, 1952, shall meet the requirements of this section.

113.50–90(b) *General requirements.*

113.50–90(b)(1) All passenger vessels the construction of which was begun prior to January 1, 1937, on which lifeboats are stowed more than 100 feet from the navigating bridge, and all passenger vessels the construction of which was begun prior to November 19, 1952, but on and after January 1, 1937, certificated to carry 1,000 persons or more including officers and crew, shall be equipped with a loudspeaker system which shall enable an officer on the bridge to broadcast separately or collectively to the stations listed in this subparagraph.

113.50–90(b)(1)(i) Lifeboat stations, port and starboard. (The deck or decks on which lifeboats are stowed and from which they are launched.)

113.50–90(b)(1)(ii) Embarkation deck, port and starboard. (The deck or decks, designated by construction design or by the vessel's station bill, used for the embarkation of passengers and crew into lifeboats. If lifeboat stations are used for embarkation purposes, this requirement will be omitted.)

113.50–90(b)(1)(iii) Main quarters for crew. (The quarters of the emergency squad, deck crew, and stewards assigned to passenger quarters.)

113.50–90(b)(1)(iv) Public spaces. (The spaces designated by the vessel's station bill where passengers and crew are to assemble in an emergency.)

113.50–90(b)(2) The Commandant may, in special cases, exempt passenger vessels the construction of which was begun prior to January 1, 1937, having a small number of especially accessible lifeboats stowed more than 100 feet from the bridge: *Provided*, *however*, That no such vessel certificated to carry more than 200 persons, including officers and crew, shall be so exempted.

113.50–90(b)(3) Details of the system shall be in general agreement with Sections 113.50–5 through 113.50–35 insofar as is reasonable and practicable.

113.50–90(b)(4) Existing arrangements, materials, and facilities previously approved, but not meeting the applicable specifications or requirements set forth in Sections 113.50–5 through 113.50–35, may be continued in service so long as they are maintained in good condition to the satisfication of the Officer in Charge, Marine Inspection. Minor repairs and minor alterations may be made to the same standards as the original installation provided that, in no case, will a greater departure from the standards of Sections 113.50–5 through 113.-50–35 be permitted than presently exist. All new installations or major replacements shall meet the applicable specifications or requirements for new vessels.

113.55 NAVIGATION LIGHTS

113.55–1 Application

113.55–1(a) The provisions of this subpart, with the exception of Section 113.55–90, shall apply to all vessels contracted for on or after November 19, 1952. Vessels contracted for prior to November 19, 1952, shall meet the requirements of Section 113.55–90.

113.55–5 General requirements

113.55–5(a) All vessels and motorboats shall be equipped with navigation lights and shapes as prescribed by law and regulation.

113.55–10 Construction of navigation lights

113.55–10(a) Navigation lights shall be of an approved type.

113.55–15 Installation of navigation lights

113.55–15(a) Navigation lights shall be installed in such a manner that the angles of visibility and the minimum heights above the deck required by the applicable Rules of the Road will be assured.

113.55–15(b) The light from a navigation light shall not be obscured by any part of the vessel's structure or rigging.

113.55–15(c) Navigation lights shall be wired by means of a short length of heavy duty portable cable to a watertight receptacle outlet located adjacent thereto. Where the double lens, two-lamp type electric navigation light is installed, each lamp shall be connected to its branch circuit conductors by means of an individual portable cable and receptacle plug.

113.55–20 Light screens

113.55–20(a) Light screens required by the Rules of the Road for port and starboard side lights shall be painted with a glossy black paint and shall project not less than 3 feet forward of the center of the light source.

113.55–25 Navigation light indicator panel

113.55–25(a) Self-propelled vessels of 1,600 gross tons and over shall be provided with a navigation light indicator panel located in the wheelhouse to control electric side, masthead, range, and stern lights. The panel shall provide visible and audible indications of the failure of any of the above named navigation lights.

113.55–25(b) Recommended circuit diagrams for navigation light indicator panels are shown in Figure 113.55–25(b). Other circuit diagrams may be submitted for approval.

113.55–90 Navigation lights for existing vessels

113.55–90(a) Navigation lights on vessels contracted for prior to November 19, 1952, shall meet the requirements covered in this section.

113.55–90(b) Existing arrangements, materials, and facilities previously approved will be considered satisfactory so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and minor alterations may be made to the same standard as the original installation.

113.55–90(c) All new installations or major replacements shall meet the applicable specifications or requirements.

113.60 SIGNALING LIGHTS

113.60–1 Application

113.60–1(a) The provisions of this subpart, with the exception of Section 113.60–90, shall apply to vessels contracted for on or after November 19, 1952. Vessels contracted for prior to November 19, 1952, shall meet the requirements of Section 113.60–90.

113.60–5 General requirements

113.60–5(a) Except as modified by Section 33.50–1 of Subchapter D (Tank Vessels) of this chapter, all ocean and coastwise self-propelled vessels of over 150 gross tons shall be equipped with an efficient daylight signaling light of the type covered by this subpart.

113.60–10 Detail requirements

113.60–10(a) The signaling light shall consist of a device which produces a narrow high-intensity beam of light suitable for daylight blinker communication at speeds up to 9 words (180 dots and/or dashes) per minute.

113.60–10(b) The axial candlepower of the beam shall be not less than 60,000 candlepower. The beam shall have a total horizontal and vertical divergence of approximately 6 degrees. This divergence is defined as the angular limits of the beam where the candlepower has fallen to one-tenth of the axial candlepower.

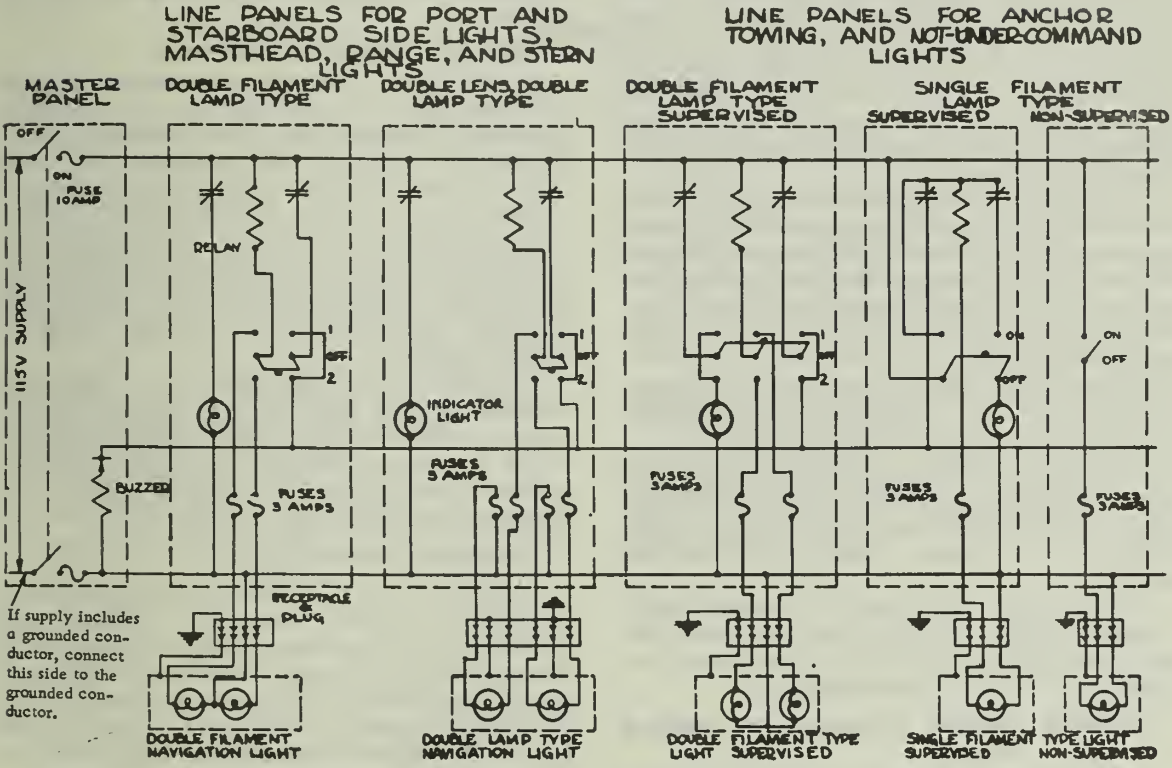
113.60–10(c) In addition to the requirements of paragraph (b) of this section, the candlepower of the beam in every direction within an angle of 0.7 degree from the axial shall not be less than 50 percent of the axial candlepower.

113.60–10(d) The signaling light shall be fitted with a suitable sighting arrangement capable of directing the beam on to the receiving station.

113.60–10(e) Signaling may be effected by keying the current through the lamp, by movement of shutters, or by other approved means.

FIGURE 113.55-25(b)

SEMI-AUTOMATIC NAVIGATION LIGHT PANEL CIRCUITS


LINE PANELS FOR PORT AND STARBOARD SIDE LIGHTS, MASTHEAD, RANGE, AND STERN LIGHTS
LINE PANELS FOR ANCHOR TOWING, AND NOT-UNDER-COMMAND LIGHTS
MASTER PANEL
DOUBLE FILAMENT LAMP TYPE
DOUBLE LENS, DOUBLE LAMP TYPE
DOUBLE FILAMENT LAMP TYPE SUPERVISED
SINGLE FILAMENT LAMP TYPE
SUPERVISED
NON-SUPERVISED
OFF
ON
FUSE 10 AMP
115V SUPPLY
RELAY
1
OFF
2
INDICATOR LIGHT
ON
OFF
BUZZER
FUSES 3 AMPS
FUSES 5 AMPS
FUSES 3 AMPS
FUSES 3 AMPS
FUSES 3 AMPS
RECEPTACLE & PLUG
If supply includes a grounded conductor, connect this side to the grounded conductor.
DOUBLE FILAMENT NAVIGATION LIGHT
DOUBLE LAMP TYPE NAVIGATION LIGHT
DOUBLE FILAMENT TYPE LIGHT SUPERVISED
SINGLE FILAMENT TYPE LIGHT SUPERVISED
NON-SUPERVISED

113.60–10(f) The signaling light may be either a fixed unit mounted on the top of the wheelhouse, a semifixed unit with arrangements for quick mounting at either wing of the navigating bridge, or a portable unit.

113.60–10(g) Fixed or semifixed signaling lights shall be energized from the emergency lighting and power system as required by Paragraph 112.15–5(h) of this subchapter. Portable signaling units shall be energized from a self-contained storage battery capable of operating the unit 2 hours continuously without recharging.

113.60–90 Signaling light for existing vessels

113.60–90(a) Signaling lights on vessels contracted for prior to November 19, 1952, shall meet the requirements in this section.

113.60–90(b) Ocean and coastwise ships over 150 gross tons shall be equipped with an efficient signaling lamp. This lamp shall be permanently fixed above the bridge and equipped with a Fresnel lens and high-speed bulb, operated by a weatherproof key, fitted with a suitable condenser. The lamp shall be so connected that it can be operated from the normal source of ship's current, the emergency source, and other emergency batteries if provided.

113.60–90(c) Existing arrangements, materials, and facilities previously approved will be considered satisfactory as long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and minor alterations may be made to the same standard as the original installation. All new installations or major replacements shall meet the applicable specifications or requirements for new vessels.

113.65 WHISTLE OPERATORS

113.65–1 Application

113.65–1(a) The provisions of this subpart, with the exception of Section 113.65–90, shall apply to all vessels contracted for on or after November 19, 1952. Vessels contracted for prior to November 19, 1952, shall meet the requirements of Section 113.65–90.

113.65–5 General requirements

113.65–5(a) The general requirements for whistles, sirens and fog horns are contained in Part 25 of Subchapter C (Uninspected Vessels), Part 32 of Subchapter D (Tank Vessels), Part 77 of Subchapter H (Passenger Vessels), and Part 96 of Subchapter I (Cargo and Miscellaneous Vessels), of this chapter.

113.65–5(b) Mechanical whistle or siren pull leads shall be as direct as possible and amply protected. When the leads are suspended for more than 15 feet, they should be supported from a corrosion-resistant cable with suitable bearers. The system shall be provided with ample corrosion-resistant springs to relieve all weight on the lever and for the proper functioning of the system.

113.65–5(c) Materials and mechanical details shall be in general accordance with the requirements for mechanical telegraphs given in Section 113.35–25 except that bronze or stainless steel aircraft type wire rope or other means specifically approved may be used in lieu of the brass wire specified.

113.65–5(d) When electrically operated whistles and sirens are installed, all parts shall be independent of the primary system.

113.65–5(e) When electrically operated valves for whistles or sirens are located more than 5 feet from the whistle, an automatic drain feature for the steam whistle pipe shall be installed.

113.65–5(f) The supply for an electrically operated whistle or siren shall be from the emergency lighting and power system as required by Part 112 of this chapter.

113.65–90 Whistle operators for existing vessels

113.65–90(a) Whistle operators on vessels contracted for prior to November 19, 1952, shall meet the requirements in this section.

113.65–90(b) Existing arrangements, materials, and facilities previously approved will be considered satisfactory so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and minor alterations may be made to the same standard as the original installation.

113.65–90(c) All new installations or major replacements shall meet the applicable specifications or requirements for new vessels.

113.70 SMOKE DETECTOR SYSTEMS

113.70–1 Application

113.70–1(a) Where a smoke detector system is installed, the provisions of this subpart, with the exception of Section 113.70–90, shall apply to all installations contracted for on or after November 19, 1952. Installations contracted for prior to November 19, 1952, shall meet the requirements of Section 113.70–90.

113.70–1(b) For the vessels on which a smoke detector system is required, see Part 76 of Subchapter H (Passenger Vessels) of this chapter.

113.70–5 General requirements

113.70–5(a) The smoke detector control unit shall be of a type approved by the Commandant. Systems installed on vessels contracted for on or after November 19, 1959, shall meet the requirements of Subpart 161.002 of Subchapter Q (Specifications) of this chapter.

113.70–5(b) All electric cable installed in conjunction with the smoke detector system shall be either leaded and armored, impervious sheathed and armored or mineral insulated metal sheathed.

113.70–5(c) Cable runs between the smoke detector control unit and the supply switchboard shall be as direct as possible and shall avoid staterooms, lockers, and other enclosed spaces where the cable could be damaged by a localized fire or by other causes.

113.70–10 Power supply

113.70–10(a) On vessels fitted with an automatically started emergency lighting and power system, the smoke detector system shall be supplied by a branch circuit from the emergency switchboard. On vessels fitted with a temporary source of emergency lighting and power, the branch circuit may be connected to the temporary emergency source of supply.

113.70–10(b) On vessels not fitted with an automatically started emergency lighting and power system, the smoke detector system shall be supplied from a source as approved by the Commandant.

113.70–90 Equipment and installations on vessels contracted for prior to November 19, 1952

113.70–90(a) Existing arrangements, materials, and facilities previously approved, but not meeting the applicable specifications or requirements set forth in Sections 113.70–5 and 113.70–10, may be continued in service so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and minor alterations may be made to the same standards as the original installation: *Provided*, That, in no case, will a greater departure from the standards of Sections 113.70–5 and 113.70–10 be permitted than presently exist. All new installations or major replacements shall meet the applicable specifications or requirements for new vessels.

APPENDIX

RIGHT OF APPEAL

2.01 INSPECTING AND CERTIFICATING OF VESSELS

2.01–70 Appeals

2.01–70(a) *General.* Any person aggrived by any decision or action of the Officer in Charge, Marine Inspection, may appeal therefrom to the Coast Guard District Commander of the district in which the action or decision was made. A further appeal may be made to the Commandant, U.S. Coast Guard, from the decision of the District Commander.

2.01–70(b) *Time Limits.*

2.01–70(b)(1) Appeals from decisions of the inspectors or the Officer in Charge, Marine Inspection, to the Coast Guard District Commander, shall be made in writing within 30 days after the decisions or actions appealed from shall have been rendered or taken. Such appeals shall set forth the requirements appealed from and the reasons why the decision or action should be set aside or revised.

2.01–70(b)(2) Appeals from the decisions of the Coast Guard District Commander to the Commandant shall be made in writing within 30 days after the decisions appealed from shall have been rendered.

2.01–70(c) *Decision on appeals.* Pending the determination of the appeal, the decision of the Officer in Charge, Marine Inspection, shall remain in effect. The decision of the Commandant is final.

CHANGES MADE IN TEXT SINCE LAST EDITION

46 CFR SUBCHAPTER J

The changes made in the text since the last edition are indicated by a (★) preceding the section, paragraph, or subparagraph numbers in the body of the text.

Federal Register, December 30, 1965, Vol. 30, No. 251, page 17036.
Federal Register, December 6, 1966, Vol. 31, No. 235, page 15288.
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COAST GUARD DISTRICT COMMANDERS AND MERCHANT MARINE ACTIVITIES

District	Title	City	State	Address
1st	Commander, 1st Coast Guard District.	Boston	Massachusetts 02203	J. F. Kennedy Federal Building Government Center.
	Chief, Merchant Marine Safety Division.	do	do	Do.
	Officer in Charge, Marine Inspection.	do	Massachusetts 02109	427 Commercial St.
	do	Portland	Maine 04112	P.O. Box 108, Pearl Street Station.
	do	Providence	Rhode Island 02903	409 Federal Bldg.
2d	Commander, 2d Coast Guard District.	St. Louis	Missouri 63103	Federal Bldg., 1520 Market St.
	Chief, Merchant Marine Safety Division.	do	do	Do.
	Officer in Charge, Marine Inspection.	do	do	Do.
	do	Cairo	Illinois 62914	P.O. Box 391.
	do	Dubuque	Iowa 52001	Box 695.
	do	Cincinnati	Ohio 45202	Room 8413, Federal Office Bldg., 550 Main St.
	do	Louisville	Kentucky 40202	254 Francis Bldg., 4th and Chestnut Sts.
	do	Memphis	Tennessee 38103	856 Federal Bldg., 167 North Main St.
	do	Nashville	Tennessee 37203	670 U.S. Courthouse, 801 Broadway.
	do	Pittsburgh	Pennsylvania 15219	1032 U.S. Post Office and Courthouse Bldg.
	do	Huntington	West Virginia 25701	328 Post Office and Federal Courthouse Bldg., 5th Ave. and 9th St.
3d	Commander, 3d Coast Guard District.	New York	New York 10004	Governors Island.
	Chief, Merchant Marine Safety Division.	do	do	Do.
	Officer in Charge, Marine Inspection.	do	do	Battery Park Bldg.
	do	Albany	New York 12207	313 Federal Bldg.
	do	Philadelphia	Pennsylvania 19106	Customhouse.
5th	Commander, 5th Coast Guard District.	Portsmouth	Virginia 23705	Federal Bldg., 431 Crawford St.
	Chief, Merchant Marine Safety Division.	do	do	Do.
	Officer in Charge, Marine Inspection.	do	do	200 Federal Bldg.
	do	Wilmington	North Carolina 28401	101–105 Customhouse.
	do	Baltimore	Maryland 21202	Customhouse.
7th	Commander, 7th Coast Guard District.	Miami	Florida 33130	Room 1203, Federal Bldg., 51 Southwest 1st Ave.
	Chief, Merchant Marine Safety Division.	do	do	Do.
	Officer in Charge, Marine Inspection.	do	do	Room 1202, Federal Bldg., 51 Southwest 1st Ave.
	do	Tampa	Florida 33601	Room 210, 500 Zack St., P.O. Box 3172.
	do	Charleston	South Carolina 29403	Room 625, Federal Bldg., 334 Meeting St.
	do	Savannah	Georgia 31402	P.O. Box 191.
	do	Jacksonville	Florida 32201	210 Federal Bldg., P.O. Box 4968.
	do	San Juan	Puerto Rico 00904	302 Federal Bldg., P.O. Box 3666.

District	Title	City	State	Address
8th	Commander, 8th Coast Guard District.	New Orleans	Louisiana 70130	Customhouse.
	Chief, Merchant Marine Safety Division.	do	do	Do.
	Officer in Charge, Marine Inspection.	do	do	310 Customhouse, 423 Canal St.
	do	Mobile	Alabama 36602	563 Federal Bldg.
	do	Port Arthur	Texas 77640	1601 Proctor St.
	do	Galveston	Texas 77550	232 Customhouse.
	do	Corpus Christi.	Texas 78401	101 Federal Bldg.
	do	Houston	Texas 77011	7300 Wingate St.
9th	Commander, 9th Coast Guard District.	Cleveland	Ohio 44113	Main Post Office Bldg., West 3d and Prospect Sts.
	Chief, Merchant Marine Safety Division.	do	do	Do.
	Officer in Charge, Marine Inspection.	do	Ohio 44114	1055 East 9th St.
	do	Buffalo	New York 14203	440 Federal Bldg., 121 Ellicott St.
	do	Oswego	New York 13126	205 Federal Bldg.
	do	Detroit	Michigan 48226	424 Federal Bldg.
	do	Duluth	Minnesota 55802	311 Federal Bldg.
	do	Toledo	Ohio 43604	5101 Federal Bldg., 234 Summit St.
	do	Saint Ignace	Michigan 49781	Municipal Bldg.
	do	Chicago	Illinois 60617	10101 South Ewing Ave.
	do	Ludington	Michigan 49431	P.O. Box 308.
	do	Milwaukee	Wisconsin 53203	Room 400, 135 West Wells St.
11th	Commander, 11th Coast Guard District.	Long Beach	California 90802	Heartwell Bldg., 19 Pine Ave.
	Chief, Merchant Marine Safety Division.	do	do	Do.
	Officer in Charge, Marine Inspection.	Wilmington	California 90744	(Los Angeles-Long Beach), Center Bldg., 750 North Broad Ave.
	do	San Diego	California 92101	Room 12A, Broadway Pier.
12th	Commander, 12th Coast Guard District.	San Francisco	California 94126	630 Sansome St.
	Chief, Merchant Marine Safety Division.	do	do	Do.
	Officer in Charge, Marine Inspection.	do	do	Station B, Box 2029.
13th	Commander, 13th Coast Guard District.	Seattle	Washington 98104	618 2d Ave.
	Chief, Merchant Marine Safety Division.	do	do	Do.
	Officer in Charge, Marine Inspection.	do	do	Do.
	do	Portland	Oregon 97204	Room 202, Lincoln Bldg., 208 Southwest 5th Ave.
14th	Commander, 14th Coast Guard District.	Honolulu	Hawaii 96814	1347 Kapiolani Blvd.
	Chief, Merchant Marine Safety Division.	do	Hawaii 96813	610 Fort St.
	Officer in Charge, Marine Inspection.	do	do	Do.
	do	Guam		Marianas.

District	Title	City	State	Address
17th-----	Commander, 17th Coast Guard District.	Juneau-------	Alaska 99801---------	P.O. Box 3-5000.
	Chief, Merchant Marine Safety Division.	-----do-------	-----do---------------	Do.
	Officer in Charge, Marine Inspection.	-----do-------	-----do---------------	Do.
	-----do----------------------	Anchorage----	Alaska 99501---------	P.O. Box 1286.

Merchant marine details	Local addresses
LONDON	Commander, Coast Guard Activities, Europe Staff Box 5, 7 North Audley Street, LONDON, W.1., England.
BREMEN	Merchant Marine Detail Officer, USCG American Consulate General, 1, Praesident Kennedy Platz, BREMEN, Germany.
NAPLES	Merchant Marine Detail Officer, USCG American Consulate General, Piazza Principe di Napoli, NAPLES, Italy.
ROTTERDAM	Merchant Marine Detail Officer, USCG American Consulate General, Vlasmarkt 1, ROTTERDAM, Netherlands.
YOKOHAMA	Merchant Marine Detail Officer, USCG North Pier, YOKOHAMA, Japan.

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